Vol. 10, No. 21
November 15, 1985

Energy Research Abstracts

Abstracts 43614-45931

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription (use PB85-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic (North America) or $28.00 for foreign (outside North America); a single issue is $8.00 or $16.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB85-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers; a single issue is $7.00 and $14.00, respectively.

***Current Energy Patents (CEP)*–PB85-902800**

Devoted to international patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB85-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB85-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB85-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB85-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic (North America) and $80.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB85-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB85-900700**

Covers worldwide information on the technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB85-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB85-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB85-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB85-900600**

Covers worldwide information on all aspects of biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB85-914700**

Covers information on the exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*– PB85-900500**

Covers all aspects of heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB85-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB85-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB85-913500**

Covers the safety aspects of accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB85-902900**

Covers the management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB85-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB85-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The GPO Stock Number is 061-000-00657-5 and the price is $83.00 for the Vol. 9 indexes. The cumulative indexes are also available in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

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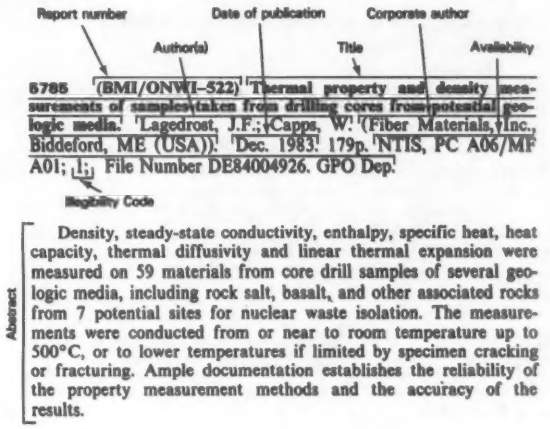
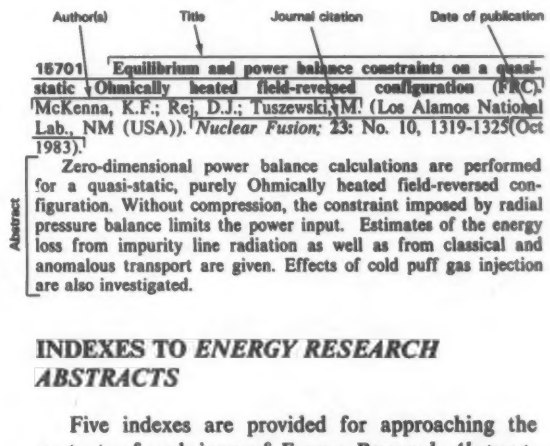
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Eligibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J:US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
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Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522 9:5785 **NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70**

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Foreign Sources

CEA Centre d'Etudes de Saclay
GIF-sur Yvette Cedex, France

Fachinformationszentrum
Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
Dublin, Ireland

IEA Coal Research
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Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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43614 (AD-A—154797/5/XAB) Linear-programming-based coal preparation and blending technique. Final report. Van Drew, S.L. (Army Military Personnel Center, Alexandria, VA (USA)). 10 Apr 1985. 128p. NTIS, PC A07/MF A01.

Master's thesis.

The purpose of this study is to formulate and code a mathematical model of the coal blending and preparation process at the Martiki Coal mine in Lovely, Kentucky, which will reduce wash loss by improving the daily tonnage and specific gravity decision. A model of the Martiki Coal Corporation blending and preparation process is developed with minimization of wash loss as the objective. Solution is by iterative linear programming using the Tucker Tableau algorithm on an Apple II microcomputer. Output serves as an aid to preparation plant personnel in making the daily specific gravity and tonnage decision. Each percentage reduction in Martiki's 1984 wash loss would have decreased disposal costs and increased revenues by approximately $550,700.

43615 (BMFT-FB-T—85-063) Market trend analyses of coal hydrogenation - study. Vinke, A.; Heger, N. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1985. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752673.

The basis for the macro- and/or micro-analyses for the economic justification of the intended project is an assumed model of a large-scale coal hydrogenation plant. Under the assumption that cost and profit (base 1983) remain unchanged, coal and processing cost will summarize to 1337.-DM/t of product, as against returns of 689.-DM/t. Assuming a real earnings growth of 1% p.a. and coal cost of 116.-DM/t, the plant may already be operated under private conditions. An additional subsidy to investment of 50% and limiting the return on equity to 3% p.a. after tax permit to run the plant without further running subsidies, at coal cost of 195.-DM/t. Sensitivity analyses show the influence of different variables on highest acceptable coal cost. Under assumption of a fully employed economy the used input/output method finds out job opportunities of total 163.000 man-years during construction period and permanent 48.000 man-years during operation period.

43616 (BNL—36713) Flash pyrolysis of coal with reactive and non-reactive gases. Steinberg, M.; Fallon, P.T.; Sundaram, M.S. (Brookhaven National Lab., Upton, NY (USA)). Jun 1985. Contract AC02-76CH00016. 6p. (CONF-851003—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016055.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Flash pyrolysis of coal indicates increasing yield of gaseous hydrocarbons with gas film heat transfer coefficient progressing, for the inert gases, from Ar to N_2 to He and, for the reactive gases, from CO to CH_4 to H_2. The flash methanolysis of coal with methane gas indicates increasing ethylene and benzene yields with CH_4/coal ratio and with He and N_2 dilution. The mechanism for the enhanced yield appears to be by a coal free-radical reaction with methane. 4 refs., 4 figs.

43617 (CONF-831205—9) Status review of direct coal liquefaction technology. McNeese, L.E.; Irvine, A.R.; Cochran, H.D.; Salmon, R. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016385.

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

Direct liquefaction of coal, which was first practiced in Germany during World War II, has been under further development in the US and elsewhere for more than a decade. This paper reviews the status of the major developing technologies required for operation of a direct coal liquefaction facility. The subjects addressed include the status of technology of coal dissolution chemistry, coal dissolution reactor design, coal slurry preheaters, high pressure vapor/liquid separators, residue production, product upgrading, slurry pumps, pressure let-down valves, and general instrumentation. In general, it is concluded that the technology is adequate to permit satisfactory performance in the several areas; however, quite substantial improvements are possible in most cases. 3 figs., 3 tabs.

43618 (CONF-850836—2) Online database for materials performance and design data for direct coal liquefaction. Caton, G.M.; Gove, N.B.; Olsen, A.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016321.

From American Institute of Chemical Engineers national meeting; Seattle, WA, USA (25 Aug 1985).

The LMD consists of 14 interrelated databases and has been established on the System 1022^2 database management system. This general purpose data management software system is capable of fast storage, sorting, and retrieval of large collections of records. It can easily be used interactively and has a comprehensive report writer available to display the data with any level of formatting. System 1022 operates on DECsystem-10 and is maintained by the Computing and Telecommunications Division of Martin Marietta Energy Systems, Inc. A menu-driven interface to the various computer files on System 1022 has been designed to enable an infrequent user to easily access the data without using any specific System 1022 commands or query language. 5 refs.

43619 (CONF-851003—1) Oxygen loss and the conversion of coal. Ross, D.S.; Hum, G.P.; Green, T.K. (SRI International, Menlo Park, CA (USA); Western Kentucky Univ., Bowling Green (USA)). 1985. Contract FG22-83PC60778. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010650.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Bituminous coal conversions in CO/water at 400°C have demonstrated that O-loss and conversion (toluene solubility) are not directly related. About half the coal oxygen is consistently lost over a range of conversions, from virtually no conversion to yields up to 50%. While loss is from the nonphenolic oxygen in the coal, it is difficult to reconcile these results with the common view that ether cleavage is a key conversion step. 8 refs., 2 tabs.

43620 (CONF-851003—9) Role of iron sulfides stoichiometry in the direct liquefaction of coal. Montano, P.A.; Stenberg, V.I. (Argonne National Lab., IL (USA); West Virginia Univ., Morgantown (USA); North Dakota Univ., Grand Forks (USA)). Jun 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014993.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

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It is found that the stoichiometry of the iron sulfides is determined by the H_2S partial pressure and that greater activity is observed when the surface is rich in vacancies. There is great affinity of the sulfides towards cleavage of oxygen bonds in coal and model compounds. 10 refs., 2 figs., 1 tab.

43621 **(DOE/ET/10069—T114) EDS coal liquefaction process development, Phase V. Quarterly technical progress report, January 1-March 31, 1985.** (Exxon Research and Engineering Co., Annandale, NJ (USA)). Jun 1985. Contract FC05-77ET10069. 30p. (FE—2893-155). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. File Number DE85016601.

Highlights from this report are summarized as follows. They are grouped according to their corresponding reporting categories in the report. Repeated oral dosing (5 day/week for thirteen weeks) of EDS fuel oil at levels up to 0.5 gru/kg/day was not associated with substantial toxicity. No evidence was found that EDS fuel oil was teratogenic in studies with rats. The number of live fetuses declined in a dose related manner and there are some evidence of dose related maternal toxicity. It was not possible to determine whether the observed fetotoxicity was the direct result of treatment or was secondary to maternal toxicity. The water soluble fractions of the EDS higher boiling materials were found to be more toxic than those of petroleum derived middle distillates. 7 refs., 4 figs., 4 tabs.

43622 **(DOE/FC/10601—1910) Kinetic model development for low-rank coal liquefaction. Progress report, March 31-July 31, 1984.** Anthony, R.G.; Philip, C.V.; Koker, A.; Moore, P.; Tarng, Y. (Texas A and M Univ., College Station (USA). Kinetics, Catalysis, and Reaction Engineering Lab.). Aug 1984. Contract AC18-83FC10601. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017933.

Progress reports are presented for the following tasks: (1) batch liquefaction of ZAP-2 lignite with a UNDERC-PDU-recycle solvent; (2) estimation of parameters in a bubble column reactor for coal liquefaction; and (3) analysis of the coal derived products. During this quarter the emphasis has been on the refining of the experimental techniques for conducting the tubing bomb reactor experiments, analyzing the products by size exclusion chromatography (SEC) and size exclusion chromatography combined with gas chromatography (SEGC). The contents of the tubing bomb microreactors are mixed by insertion of a short 1.5 mm stainless steel rod inside the reactor. The reactors are agitated by shaking at 400 cpm. A cold experiment with mineral oil in a glass tube was used to test the degree of mixing. Data are reported that were obtained by agitating the reactors at 220 cpm which was believed to be adequate. However, because the data show repolymerization, the system was redesigned to operate at 400 cpm. The data which show polymerization and condensation of THF soluble material were also taken at 793°K. This high temperature combined with the fact that the product slurry is probably not a very good hydrogen donor solvent could also have caused the polymerization of the THF solubles. The SEGC analysis procedure has been modified to collect all of the sample from the SEC. The previous procedure collected only 100 microliter samples. The procedure was changed to insure that no components were missed. SEC's of ZAP-2, B-3, Wyodak and Big Brown product slurries are presented in this report. Quantitative analysis should be possible by the end of the next quarter. 8 refs., 15 figs., 7 tabs.

43623 **(DOE/FC/10601—1912) Kinetic model development for low-rank coal liquefaction. Progress report, August 1-December 31, 1984.** Anthony, R.G.; Philip, C.V.; Koker, A.; Helton, T.; Moore, P.; Tarng, Y. (Texas A and M Univ., College Station (USA). Kinetics, Catalysis, and Reaction Engineering Lab.). Jan 1985. Contract AC18-83FC10601. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017932.

Kinetic data on the dissolution of Indian Head ZAP-2 lignite in its recycle solvent with hydrogen/hydrogen sulfide, carbon monoxide/hydrogen sulfide, hydrogen, carbon monoxide, hydrogen/carbon monoxide/hydrogen sulfide, and hydrogen/carbon monoxide at temperatures of 653, 673, 693 and 713°K shows that the hydrogen sulfide accelerates the rates of reactions for dissolution as well as for retrogressive reactions. The hydrogen sulfide tended to decrease gas yields when used with CO. The use of H_2/CO as compared to hydrogen resulted in higher gas and THF soluble yields. Retrogressive reactions occurred at the two highest temperatures at reaction times greater than 5 minutes. For the lower temperatures the retrogressive reactions began to occur after 15 minutes. 12 figs., 3 tabs.

43624 **(DOE/METC—85/5) Tenth annual underground coal gasification symposium: proceedings.** Burwell, E.; Docktor, L.; Martin, J.W. (eds.). (USDOE Morgantown Energy Technology Center, WV). Dec 1984. 627p. (CONF-840835—). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85001956.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The Tenth Annual Underground Coal Gasification Symposium was cosponsored by the Fossil Energy Division of the US Department of Energy and the Morgantown Energy Technology Center's Laramie Projects Office. The purpose of the symposium was to provide a forum for presenting research results and for determining additional research needs in underground coal gasification. This years' meeting was held in Williamsburg, Virginia, during the week of August 12 through 15, 1984. Approximately 120 attendees representing industry, academia, national laboratories, Government, and eight foreign countries participated in the exchange of ideas, results, and future research plans. International representatives included participants from Belgium, Brazil, France, the Netherlands, New Zealand, Spain, West Germany, and Yugoslavia. During the three-day symposium, sixty papers were presented and discussed in four formal presentation sessions and two informal poster sessions. The papers describe interpretation of field test data, results of environmental research, and evaluations of laboratory, modeling, and economic studies. All papers in this Proceedings have been processed for inclusion in the Energy Data Base.

43625 **(DOE/PC/50800—T11) Transport and relaxation processes in supercritical fluids. Technical progress report, April 1, 1985-June 30, 1985.** Jonas, J. (Illinois Univ., Urbana (USA). Dept. of Chemistry). 1985. Contract FG22-82PC50800. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015595.

Progress reports are presented for the following studies: (1) development of FT IR technique for determination of solubilities of solids in supercritical fluids; (2) apparatus for FT IR technique; (3) naphthalene solubility measurements in supercritical CO_2; and (4) diffusion measurements of solids dissolved in supercritical fluids. In the development of FT IR technique for determining solubility of solids in supercritical fluids, the investigators present a new spectroscopic technique. Solubilities of solids in gases are determined by measuring absorption intensity in the IR region. The technique was tested with anthracene in carbon dioxide. This system was chosen for several reasons - vapor pressure of anthracene is well known, melting point is high, 216C, so the solubility of CO_2 in anthracene can be neglected. Solubilities of anthracene in CO_2 were determined experimentally for several temperatures and pressures. Data are presented. 5 figs.

43626 **(DOE/PC/60017—T1) New technology concept for two-stage liquefaction of coal.** Comolli, A.G.; Ganguli, P.; Harris, E.; MacArthur, J.B.; McLean, J.B.; Smith, T.O. (Hydrocarbon Research, Inc., Lawrenceville, NJ (USA)). Aug 1985. Contract AC22-83PC60017. 428p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE85016804.

Hydrocarbon Research, Inc. (HRI) has completed the first year of a two-year study for the evaluation of a "New Technology Concept for Two-Stage Liquefaction of Coal". A two-stage liquefaction process concept has been developed and demonstrated which features two closely coupled, catalytic ebullated-bed reaction stages, with the first stage operated at low temperature to achieve efficient hydrogenation. This report covers the first year's program which was devoted to the study of Illinois No. 6 bituminous coal. Experimental investigations included nine runs in a continuous bench unit covering 176 days of on-stream operation, and over 700 supporting batch microautoclave tests. A wide range of process variables, including temperature, residence time, pressure, and recy-

cle composition, were evaluated. Several different catalysts were also tested. Product characterization studies by other DOE contractors, which support the conclusions presented by HRI, are also appended. Process development studies culminated in a 25-day bench-scale demonstration run, at conditions selected based on the results of previous process variable runs. This run achieved C_4-975°F distillate yields of 65 W % (or 4.2 barrels per ton) of moisture, ash free coal. Lower yields of gas and residuum, as well as improved product qualities relative to previous single stage and alternative configuration two-stage studies, were also demonstrated. Liquid products were considerably more aliphatic or petroleum-like than those produced from other two-stage processes. The efficient hydrogenation conditions of the first stage, where coal is substantially liquefied simultaneously with catalytic hydrogenation of recycle and product oils, make this a unique process concept and are considered the key to the outstanding results obtained. 39 figs., 90 tabs.

43627 (DOE/PC/60781—7) Novel catalytic methods for heteroatom removal in coal liquids upgrading. Quarterly report No. 7, March 1-June 1, 1985. Laine, R.M.; Hirschon, A.S.; Wilson, R.B. Jr. (SRI International, Menlo Park, CA (USA)). Jun 1985. Contract FG22-83PC60781. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015389.

The goal of this project is to optimize the reaction conditions for upgrading coal liquids. Results for this quarter are summarized below by task. Task 1: This quarter we tested the effect of H_2S on a sulfided NiMo catalyst obtained from Harshaw. We found that, unlike our results with the CoMo catalyst, the addition of H_2S to the NiMo catalyst showed no effect on the HDN process under our conditions for upgrading an SRC-II liquid. However, CoMo with H_2S is almost as effective as NiMo, but consumes less hydrogen. Task 2: We tested several of the surface-confined catalysts that were prepared last quarter and found that the bimetallic NiMo catalysts have a high degree of HDN activity, but the same product selectivity as the corresponding catalysts made by conventional methods. Based on literature references to high activity of bulk ruthenium and ruthenium sulfide towards C-C and C-S bond cleavage, we performed some preliminary experiments with bulk ruthenium to test for HDN activity. Our initial experiments have shown that ruthenium exhibits a high degree of HDN activity at lower temperatures and displays a different selectivity than that shown with conventional catalysts. In other experiments, we added ruthenium to a Harshaw CoMo catalyst and found both an increase in HDN activity, and an increase in selectivity to unsaturated HDN products. This change in selectivity is the goal of this project and could be highly significant in lowering the cost of hydrotreated coal liquids. Task 3: We also tested the effects of acid on HDN in the absence of catalysts on both a quinoline solution and on an SRC-II liquid. Our results show that acid has no apparent effect on the quinoline. However, acid reduces the nitrogen content of the SRC-II liquid to the same level as the combination of catalyst and acid. 7 refs., 8 figs., 4 tabs.

43628 (DOE/PC/70779—T1) Studies of metal/carbon surface chemistry. Reporting period: March 1, 1985-May 31, 1985. Koel, B.E. (Colorado Univ., Boulder (USA)). 30 Jun 1985. Contract FG22-84PC70779. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015548.

The purpose of this research is to identify stable surface species formed from molecular adsorption and reaction on metal/carbon surfaces. This research has practical application in improving the fundamental understanding of catalytic coal gasification. Well-defined model catalysts for carbon gasification will be studied by vapor depositing alkali and transition metal atoms on carbon surfaces. Vibrational spectroscopy using HREELS and photoelectron spectroscopy of these surfaces will be used to develop an atomic-level understanding of the chemical bonding, structure, and reactivity of the metal carbon surface and of the adsorbed molecular species. 1 fig.

43629 (EGG-MS—6852) Behavior of pressurized Incoloy 800H tubes in environments pertaining to coal gasification. Smolik, G.R.; Flinn, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1985. Contract AC07-76ID01570. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016533.

Interdependencies between applied stress and environmental parameters were investigated for Incoloy 800H pressurized tubes tested at 870°C in environments having oxygen and sulfur potentials similar to those of coal gasification processes. The sulfur potential associated with the transition from a protective oxide scale to the development of external sulfides was identified for the oxygen potential of 2×10^{-18} atm used throughout this investigation. This transition lies between 2×10^{-7} and 5×10^{-8} atm of sulfur and the transition boundary agrees well with those observed in other investigations of nonstressed coupons. The current investigation also indicated that stresses from pressurization or induced surface cracking did not promote the development of external sulfides in environments associated with the oxide forming regime. Internal damage in the form of sulfur and oxygen penetration and precipitation along grain boundaries was promoted by stresses sufficiently high to cause deformation. These penetrations were related to incurred strain, rather than stress/time history. Greater penetrations were also observed with increasing sulfur content. These substantial penetrations, relative to the 1.07 mm wall, resulted in reduced lifetimes and ductilities at higher stress levels in sulfur-bearing gases relative to those in air and an environment with an oxygen partial pressure of 1×10^{-19} atm. 19 refs., 18 figs., 4 tabs.

43630 (EPRI-AP—4176) Effects of amine solvents and oxygen functionalities on coal liquefaction. McMillen, D.F. (SRI International, Menlo Park, CA (USA). Chemical Kinetics Dept.). Aug 1985. 169p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920838.

The general objective of this project is two-fold: help determine the types of bonds that are cleaved during coal liquefaction, the mechanisms by which they are cleaved, and the types of solvent components or additives that may promote these bond cleavages; and to determine also the types of bond formation processes that occur during liquefaction and which can place severe restrictions on product yield. The principal focus has been in the following specific areas: (1) Promotion of covalent bond scission in coal structures by THQ and other amine solvents; (2) modes of degradation and incorporation of amine solvents; (3) modes of self-coupling or retrograde reactions that phenolic coal structure undergo; (4) the rates and mechanisms by which certain phenolic components can substantially enhance coal structure bond scission; (5) effect of prior swelling in amine solvents on subsequent liquefaction; and (6) possible synergism between H_2S and THQ during coal liquefaction. The studies involved a three-fold approach of: coal liquefaction, model compound studies, and hybrid studies with model structures and real coals. These studies make it possible to determine the fate of known structures under conditions that closely mimic real liquefaction conditions. The findings include the following: (1) THQ substantially accelerates the cleavage of the general classes of important coal linkages, Ar-X and Ar(OH)-X. (2) THQ and other amine solvents become covalently incorporated into a myriad of coal structures of molecular weights ranging from 200 to >800, and cannot, be removed with any physical separation process. (3) Certain dihydroxy aromatic coal structures undergo very rapid self-coupling reactions that may explain the rapid retrograde reactions shown by some coals on drying and/or oxidation. (4) Hydroquinones are effective promoters of the scission of Ar(OH)-X bonds under liquefaction conditions. 67 refs., 28 figs., 17 tabs.

43631 (MIT/CE—7862-02) Behavior of refractory linings for slagging gasifiers. Chen, E.S.; Buyukozturk, O. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Civil Engineering). Jun 1984. Contract AC05-84OR21400. 326p. (MIT/R—84-07). NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85015813.

It is the purpose of the present work to develop predictive material models and analysis capability to study the lining system behavior in gasification environment, and through analytical/numerical simulations to reach specific guidelines for the design and the operation of the lining systems. Temperature dependent material models are developed to represent the thermophysical and thermomechanical behaviors of the candidate refractory materials. In addition to the time-independent constitutive model, a creep model, a conductivity model for cracked media, and polynominal representations of thermophysical properties are proposed for the candidate materials. A special finite element program incorporating these

models is developed. A predictive corrosion model is proposed to study the long-term corrosion process of lining systems in slagging gasifiers. Based on this model, sensitivity studies, including various lining materials, lining geometries, and operating conditions, are performed to identify the important factors characterizing the long-term corrosion behavior of the linings. In the present work, the thermomechanical behavior of linings with various combinations of lining material and lining geometry, and with various heating schemes is studied. The results from these studies provide a basis for the determination of proper design and operational control for the linings in slagging gasifiers. Finally, based on the findings from the thermomechanical and corrosion analyses, recommendations are made for the design and operation of reliable and durable lining systems. 93 refs., 43 figs., 5 tabs.

43632 (PB—85-200913/XAB) Coal gasification in the molten-iron reactor. Performance of coal-gasification trials in a 60-t industrial converter of Eisenwerk-Gesellschaft Maximilianshuette MBH. (Commission of the European Communities, Luxembourg). [1985]. 27p. (In German). (EUR—9122-DE-EN). NTIS, PC E04/MF E04.

This is the final report of a demonstration project sponsored by the Commission of the European Communities. The aim of the project is long-term trials for the gasification of 300 t/d coal in an existing OBM molten-iron-bath reactor with a view to the construction and operation of a demonstration plant. The work carried out showed that different types and sizes of coal can be gasified successfully, particularly with regard to the low content of harmful substances in the gas. The advantages of the process are: high degree of coal conversion, good-quality gas (65-70% CO and 25-30% H2).

43633 (PB—85-219616/XAB) Chemistry and mechanism of molten-salt catalysts in coal-gasification processes. Final report, January 1984-January 1985. White, S.H.; Twardoch, U.M. (EIC Labs., Inc., Norwood, MA (USA)). Feb 1985. 79p. NTIS, PC A05/MF A01.

See also PB84-198514.

Alkali metal salts have been recognized as effective catalysts in coal gasification. However, the presence of reducing gases, in particular carbon monoxide, has recently been shown to have serious inhibitory effects on the catalyst performance. This program has addressed the question of the chemical interactions between carbon monoxide gas containing mixtures and the salt catalysts in liquid form by probing the solution chemistry by dynamic electrochemical techniques. The results of this study show that oxalate ions are formed by the reaction between carbonate ions and carbon monoxide gas. At temperatures above 700°C, sulfate ions are directly attacked by carbon monoxide. The oxalate ions are electroactive and their electrochemistry has been studied and found to involve adsorption of oxalate and formation of reactive intermediates. The pathway likely involves an ECE sequence. The formation of active adsorbed species such as oxalate or sulfides at high temperature may be the means by which catalytic function of the salts is inhibited.

43634 (PB—85-220614/XAB) Hydrogen sulfide removal from hot gas and concentration of sulfur using electrochemistry. Annual report, August 1983-August 1984. Winnick, J. (Georgia Inst. of Tech., Atlanta (USA). School of Chemical Engineering). Jan 1985. 84p. NTIS, PC A05/MF A01.

The virtual omnipresence of sulfur in fossil fuels raises concern regarding the increased use of coal for high-temperature fuel utilization and conversion processes. A typical raw gas composition from burning Illinois No. 6 coal (3.9% sulfur) in an air-blown gasifier is 19.6% CO, 8.1% CO_2, 10%H_2, 3.4%H_2O, 3% CH_4, 0.6% H_2S with the balance being inerts. This gas has several potential uses. Of most interest is its conversion to high-BTU SNG which requires passage over a methanation catalyst at 300-400C. The methanation catalysts, however, are sensitive to even small (5ppm) concentrations of H_2S. Thus, in the absence of a very effective high-temperature sulfur clean-up process, the gas must be cooled to the temperatures of operation of commercially available processes (e.g., Selexol or Rectisol). The use of high-temperature clean-up is estimated to allow savings of up to 7% of the energy value of the gas. Since a high-temperature sulfur-removal process is desirable several have undergone examination. Most are based on reaction of a metal oxide with the H_2S, with subsequent regeneration to the fresh sorbent and a concentrated stream of H_2S. This H_2S is then sent to a Claus Plant to be oxidized to elemental sulfur (and water). Difficulties of various kinds have not permitted any of these processes to as yet reach commercialization.

43635 (SAND—84-1164) Coal liquefaction research. Semiannual report, October 1983-March 1984. Granoff, B. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 82p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016807.

This semiannual report for the period October 1983-March 1984 summarizes activities in Sandia National Laboratories' continuing program of coal liquefaction research. The primary goals are to: explore novel catalytic concepts and materials for conversion of coal to liquid fuels; determine the effects of process variables on catalyst deactivation; determine the effects of coal structure and solvent properties on low temperature dissolution; study the kinetics and catalysis of hydrogen transfer reactions; develop an understanding of slurry gelling phenomena; and provide a technical assessment of coal liquefaction processes. During this period, work was performed on: the use of pyrene as a chemical probe of catalyst activity; analysis of catalysts from Wilsonville run 242 using ESCA; atmospheric pressure model compound activity testing of regenerated catalysts from Wilsonville run 242; base displacement experiments with a coal-indole complex; preliminary hydrogenation tests with Mo and Pd hydrous titanate catalysts; evaluation of the microflow reactor and high-pressure model compound tester for catalyst deactivation studies; use of the high-temperature, high-pressure Helical Screw Rheometer to study slurry gelling; and the initiation of work by MITRE on a techno-economic assessment of coal liquefaction processes. 8 refs., 7 figs., 13 tabs.

43636 (SAND—84-2140C) Coal liquefaction via low temperature, low pressure water-gas shift solvent hydrogenation. Stephens, H.P. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-851003—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010660.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Results of laboratory reactor experiments have demonstrated that mixtures of carbon monoxide and water can be reacted with polynuclear aromatic hydrocarbons at low temperatures and pressures to produce hydroaromatic hydrogen donors. Use of this technique for coal liquefaction process solvent production could eliminate the need for high pressure purified hydrogen and thereby result in substantial savings in plant construction and operating costs. 11 refs., 2 tabs.

43637 (SAND—85-0879C) Postburn roof stability analysis for the TONO CRIP UCG burn. Taylor, L.M.; Sutherland, H.J.; Kuszmaul, J.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-8508101—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017159.

From 11. annual underground coal gasification; Denver, CO, USA (11 Aug 1985).

During the Ninth Annual Underground Coal Gasification Symposium, Sutherland, Hommert, Taylor, and Benzley presented a preburn prediction for the burn, roof fall and surface subsidence for the TONO CRIP UCG site in Washington state. That burn has now been completed and postburn measurements of cavity sizes have become available. In this manuscript we show that the preburn predictions are, in general, in good agreement with the postburn examination of the burn site. Discrepancies between the predictions and the measurements are shown to arise for two reasons. The first is that the burn sequence analyzed in the prediction was not followed during the course of the experiment due to experimental difficulties. The second reason is that the stratigraphic section analyzed in the preburn predictions is slightly different from that observed above the burn. To clarify the discrepancies, the roof stability of the measured burn cavity is analyzed using the two analysis schemes that were used in the preburn analysis. The first technique is the Rubble model. It uses a continuum description of the

rubblization process that occurs as roof material fails and falls into the cavity below it. This technique is based on a standard finite element numerical analysis scheme. The second technique is the BLOCKS model. This technique divides the geologic strata into a collection of discrete, individual blocks and monitors all the collisions which occur between them. Both techniques yield very good descriptions of the roof stability for the measured burn cavity. 10 refs., 7 figs.

43638 **On the role of heating rate in rapid coal devolatilization.** Niksa, S.; Heyd, L.E.; Russel, W.B.; Saville, D.A. (Sandia National Lab., Alburquerque, NM). pp 68 of Twentieth Symposium (International) on Combustion. Pittsburgh, PA; The Combustion Institute (1984). (CONF-840801—).

From 20. international symposium on combustion; Ann Arbor, MI, USA (12 Aug 1984).

This paper examines time-resolved weight loss from two bituminous coals during heatup at heating rates which varied from 10^3 to 10^4 K/s independently of reaction temperatures (to 1300 K). A single reaction model is presented to describe yield suppression during heatup and to predict the faster generation rates with faster heating. The results indicate that increasing the pressure from vacuum to 0.19 MPa lowered the sensitivity to the heating rate and suppressed the reactive volatiles. It is determined that both ultimate yields and evolution rates increase with faster heating, particularly for condensed liquid products.

43639 **Westinghouse coal gasification process: occupational health considerations.** Simonson, A.V.; Evans, J.M.; Vandergrift, E. (Radian Corp., Salt Lake City, UT). pp 29 of Proceedings of the American Inst. of Chemical Engr. 1984 Spring National Meeting. Vol. 63B. New York, NY; A.I.C.H.E. (1984). (CONF-8405154—).

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

In 1978, the National Institute for Occupational Safety and Health (NIOSH) published a series of documents which drew together then-available knowledge and refocused attention on not only potential safety hazards but also the potential for health hazards associated with coal gasification processes. These documents indicated that the state-of-the-art for defining such potential exposures was limited. They stated that the potential for exposures to harmful substances would certainly be different from that of the most closely related and best studied industry of the time - the coking industry - and that the potential for exposure might vary, depending on the processes used.

43640 **Catalytic wet oxidation of wastewater produced in slagging fixed-bed and stirred fixed-bed coal gasifiers.** Green, D.A.; Cleland, J.G. (Research Triangle Institute, Research Triangle Park, NC). pp 24 of Proceedings of the American Inst. of Chemical Engr. 1984 Spring National Meeting. Vol. 50C. New York, NY; A.I.C.H.E. (1984). (CONF-8405154—).

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

Most practical applications of wastewater treatment for phenol oxidation involve relatively complex solutions resulting from coke quenching and the cooling of raw product gas from coal gasifiers. Stimulated by increasing interest in coal conversion, and the prospect of one or more full-scale coal gasification plants operating in the United States in the near future, a study of wet oxidation applied to actual gasification wastewater was undertaken at the Research Triangle Institute.

43641 **On-line capillary viscometer for a continuous liquefaction unit.** Fuchs, W.; Krastman, D.; Ruether, J.A.; Weiss, M.L. (Dept. of Energy, Pittsburgh, PA). pp 16 of Proceedings of the American Inst. of Chemical Engr. 1984 Spring National Meeting. Vol. 53D. New York, NY; A.I.C.H.E. (1984). (CONF-8405154—).

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

In order to obtain realistic information about the viscous behavior of process fluid, viscosity measurements should reflect flow conditions during operation. Standard analytical laboratory tests, typically taken at a single undefined shear rate, are inadequate to describe the rheology of non-Newtonian coal liquids. Also, coal-liquid samples taken from the process line will undergo changes in their physical and chemical properties in transit, and are, therefore, no longer representative when tested in the analytical laboratory. These considerations led to the development of an on-line viscometer of the capillary type, which tests the viscosity at process conditions at a series of shear rates, allowing a full description of non-Newtonian behavior. By automating the viscometer, it is possible to generate on-line calculations and graphics of shear stress vs. shear rate functions for process fluids.

43642 **University of Minnesota-Duluth low-Btu gasifier workplace environment.** Van Hoesen, S.D.; Dreibelbis, W.G.; Hunt, D.B.; Thompson, F.M. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 149-184 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

A large amount of experience has been developed concerning the IH situations that may be experienced at small, fixed-bed, low-Btu gasifiers. The major conclusion is that apparently worker exposures during normal operations can be kept well below current regulations and guidelines. It must be strongly emphasized, however, that provision of effective IH support will be an important factor in complying with current exposure regulations. Experiences encountered during the IH program suggest that the potential for employee overexposures is present and may in fact be expected if adequate IH provisions are not implemented. Carbon monoxide is likely to present the greatest potential for overexposure and, due to its high concentration in process streams, it presents a potential for acute exposures. Hydrogen sulfide and ammonia exposures may occur in certain situations. Experiences have shown that this acute exposure potential is greatest during startup and shakedown operations and that IH support to and interaction with operations is effective in reducing employee exposures. In contrast, worker exposure to coal-tar-related materials does not appear to present a significant acute exposure hazard. However, it is likely that low level, chronic exposures to these materials through inhalation and skin contact will occur. The hazard potential associated with these chronic exposures is unclear at this time; however, considering the strong activity of these materials in toxicological tests, prudence demands that worker exposures be kept as low as possible. In addition, worker medical surveillance programs should be implemented to ensure that any health effects are detected as soon as possible.

43643 **Source discharges and ambient air pollution at the coal gasifier at Kosovo.** Bombaugh, K.J. (Radian Corporation, Austin, TX). pp 185-197 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Emissions from a commercial coal gasification plant were compared with pollutants collected from the air at ground level 1 to 2 km from the plant. A source-receptor relationship was confirmed by identifying profiles of sulfur- and nitrogen-containing hydrocarbons found both in plant discharges and in collected samples. Pollutants collected included polynuclear aromatics, phenols, thiophenes, pyridines, and alkyl aromatics. Quantities collected by each receptor were proportional to the amount of time the receptor site was downwind of the source.

43644 **Overview and findings from Airlie House Retreat: Health and Environmental Research programs related to coal conversion technologies and their future directions.** Duhamel, A.P. (Office of Health and Environmental Research, U.S. Dept. of Energy, Washington, DC). pp 229-239 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

The Office of Health and Environmental Research (OHER) formally initiated its coal-conversion research programs in the fall of 1977. The major objective of the programs was, and continues to be, to ensure the environmental acceptability of the emerging energy technologies. The initial phases of the programs were oriented toward short-term issues and the development of an environmental data base that could be used not only to address those issues but also as a building block in assessing longer-term issues. These phases of the program are complete. To develop strategies for initiation of subsequent phases of the OHER programs related to coal gasification, liquefaction, and combustion, status reports have been prepared by the major laboratories engaged in health and environmental research. They include evaluations of the strengths and weaknesses of the present data bases, conclusions that can be drawn from the data bases, and recommended research.

0105 By-products

43645 (BG-Trans—07177) Studies on the degradation of cokes in the blast furnace. Tate, Mitsuru. (British Gas Corp., London; Tokyo Univ. (Japan). Inst. of Industrial Science). [1985]. Translation source information not available . 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85902047.

This report consists of 11 tables, 41 figures and 15 photographs pertaining to the study on coke degradation in blast furnaces. The tables cover the following: carbon percentage of various types of coke; ash composition of various types of coke; properties of various types of coke; distribution within the grains of the properties of E coke; distribution within the grains of the apparent density and porosity of E coke; analysis values and reaction percentage of coke in furnace; items investigated and conditions of test; texture analysis of samples; comparison of computed values and measured values of A and B cokes; and comparison of strength after reaction and reaction state of small-grained and large-grained coke.

0106 Properties

REFER ALSO TO CITATION(S) 43622, 43630, 43645, 43689, 43690, 43692, 43697, 43699, 43701

43646 (Canmet-R—84-1-E) Analysis directory of Canadian commercial coals - supplement No. 5. Bonnell, G.W. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1983. 229p. Department of Energy, Mines and Resources, Ottawa, Ontario, Canada.

Analyses and other characteristics are tabulated for 40 coals sampled in 1982 at mines or preparation plants in Nova Scotia, New Brunswick, Saskatchewan, Alberta and British Columbia.

43647 (CONF-851003—3) Characterization and reactivity of hydroxyls and ethers in coal macerals. Winans, R.; Scott, R.G.; Neill, P.H.; Dyrkacz, G.R.; McBeth, R.L.; Hayatsu, R. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85012375.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

The reactivity and distribution of oxygen functionality was studied for a series of maceral concentrates. These macerals, with and without their acid sites exchanged with metal ions, were examined using precise mass measurement pyrolysis mass spectrometry. The results suggest that there is significant variation in the oxygen containing structures between the different macerals. 10 refs., 1 fig., 2 tabs.

43648 (CONF-851003—6) ^{13}C-NMR tracer to probe coalification. Botto, R.E.; Hayatsu, R.; Scott, R.G.; McBeth, R.L.; Winans, R.E. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013890.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Solid-state NMR tracer experiments of synthetically prepared [^{13}C]lignins coalified under simulated geological conditions have illuminated a general chemical scheme for coalification. The labeling studies provide the first direct evidence for the conversion of aliphatic structures into aromatic structures during coalification. 5 refs., 2 figs.

43649 (CONF-851003—7) Analysis and characterization of chemically modified coal macerals using density gradient centrifugation. Dyrkacz, G.R.; Choi, C.Y.; Stock, L.M. (Argonne National Lab., IL (USA); Chicago Univ., IL (USA). Dept. of Chemistry). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013882.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Changes brought about in coal macerals by mild, non-destructive reactions such as -O- alkylation can be monitored by using density gradient centrifugation. Large changes in maceral group densities have been observed when active hydroxyl groups of the original coal sample are alkylated with methyl or butyl groups. All three maceral groups exhibit a shift to lower densities. When single, pre-separated density fractions are alkylated and then examined by density gradient techniques, inertinite and exinite macerals show new multiple density bands developing. This suggests that different chemical domains or different macerals can be isolated from individual maceral groups. 6 refs., 4 figs.

43650 (CONF-851003—8) Electron spin resonance of isolated coal macerals. Silbernagel, B.G.; Gebhard, L.A.; Thomann, H.; Dyrkacz, G.R.; Bloomquist, C.A.A. (Exxon Research and Engineering Co., Annandale, NJ (USA); Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013846.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Electron Spin Resonance (ESR) and Electron Spin Echo (ESE) studies of carbon radicals in coal macerals isolated by isopycnic centrifugation techniques reveal significant changes in linewidths and shapes, microwave saturation properties, and relaxation of the radicals with changing maceral class and rank. These properties are discussed in terms of the molecular structure of the coal. 7 refs., 4 figs.

43651 (DOE/MC/19205—1814) Structural concepts of coal and implications of dynamic interactions. Williams, J.M. Jr.; Vanderborgh, N.E.; Walker, R.D. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract AC21-82MC19205. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001981.

This report covers the experimental findings of a one year project to investigate the interaction between the guest (aliphatic) and host (aromatic) components of coal. A short overview of the current status of coal chemistry and coal formation is given. The thermal behavior of α-hydroxycarboxylic acids is studied and polymers prepared from them. Coals are solvent extracted and the extraction behavior discussed. Pyrolytic events of coals are quantified and evaluated with regard to the gasification of coal. Results show that only small fractions of coal are extracted by nonreactive solvents below 100°C, whereas reactive solvents, such as amines, extract significant amounts by dismembering the host. Other results show that the pyrolysis of coal is characterized by five thermal events which are quantified and related to chemical events and energies of reaction. The aliphatic material in bituminous coals is demonstrated to be separate from the aromatic component up to the micrometer size and evidence for the introduction of the aliphatic component by plants via triglycerides along with the bulk of the coal is presented. 82 refs., 60 figs., 11 tabs.

43652 (DOE/PC/50807—12) Reaction calorimetry for coal chemistry and catalysis. Final report, August 1, 1982-July 30, 1985. Arnett, E.M. (Duke Univ., Durham, NC (USA). Dept. of Chemistry). 1985. Contract FG22-82PC50807. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015816.

All of the areas of research proposed for study in our 1982 proposal have been attacked, but with differing degrees of intensity and success. (1) The most intensive and successful study has been a thermochemical comparison of heats of reaction of a series of nitrogen bases with p-toluene-sulfonic acid solutions (mostly in acetonitrile) and solid Dowex sulfonic acid resin in the same solvent. An excellent linear correlation between these homogeneous and hetrogeneous acids bearing the same acidic function proves the capability of the thermochemical approach to relating the acidity of solid Broensted acids to well-established scales of acidity for solutions. (2) Several samples of silica gels have been examined as prototype hydrogen-bonding acids and are presently under intense study as models for solid acids which react through hydrogen bonds. (3) A flow adsorption calorimeter system capable of operating from ambient conditions to 300°C and 5500 psi has been built and used to study the interaction of silica gel with isopropylamine in isopentane solution from ambient conditions through the supercritical regime to 250°C and 1500 psi. This is (to the best of our knowledge) the first such study and opens a wide range of research of importance to fossil fuel chemistry. (4) Heats of immersion of three types of coal have been measured in many of the same liquid bases to study Dowex resin, as a prototype solid Broensted acid, and silica gel as a prototype hydrogen bonding acid. These solids and several others were compared in terms of their thermochemical acidities by means of a multiparameter correlation equation which is shown as a promising approach to classifying the various of acid-base interactions of solids. 33 refs., 14 figs., 7 tabs.

43653 (IS-M—544) Application of scanning electron microscopy and automated image analysis for characterization of mineral matter in coal. Straszheim, W.E.; Markuszewski, R. (Ames Lab., IA (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Engineering Science and Mechanics). 1985. Contract W-7405-ENG-82. 10p. (CONF-850417—26). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015513.

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

Automated Image Analysis (AIA) in conjunction with Scanning Electron Microscopy (SEM) and energy-dispersive x-ray analysis (EDX) constitutes a very powerful tool for the in-situ characterization of mineral matter in coal. This AIA-SEM technique provides detailed information on size, shape, composition, and association of mineral phases with the coal matrix. In addition, the in-situ capability of the SEM and EDX techniques is augmented by computer control to provide quantitative information on the distribution of the mineral species present in coal. The AIA-SEM technique has been aplied to many samples of bituminous and sub-bituminous coals to characterize their mineral content. Some of the fundamental aspects of AIA as an analytical technique for coal are described. The description includes construction of suitable chemistry files for mineral phase definitions, the numbers of particles needed to develop reliable results and adequate reproducibility between samples, difficulties arising from a wide spead in the minimum and maximum particle sizes, comparison of AIA results with other characterization methods as x-ray diffraction and Fourier transform infrared (FTIR) analyses, the problems encountered in quantitation, such as the artificial enrichment of pyrite content due to instrumental factors. 8 refs., 6 tabs.

43654 Chemistry and characterization of coal macerals: overview. Winans, R.E.; Crelling, J.C. (Argonne National Lab., IL). *ACS Symposium Series;* No. 252, 1-20(1984). Contract W-31-109-ENG-38.

The papers in this journal highlight the past research on coal macerals and are aimed at characterizing in some way the various macromolecules that comprise the many kinds of coal macerals. The material in the journal is divided into the following sections: the Maceral Concept, Maceral Characterizations, Development of Petrographic Characterization, Separations, Characterization, Aromacity, Free Radicals in Macerals, Organic Structural Analysis, Direct Characterizations, Reactivity of Macerals in Conversion Processes, and Conclusions. 96 references.

0108 Waste Management

REFER ALSO TO CITATION(S) 43640, 43949, 44168, 44925, 45081, 45090

43655 (DOE/PC/60264—T1) Development of a combined NO/sub x/SO_2 removal system based on ZnO scrubbing technology. Fourteenth monthly technical progress report, July 1-July 31, 1985. Rosenberg, H.S.; Nuzum, H.K. (Battelle Columbus Labs., OH (USA)). 15 Aug 1985. Contract AC22-83PC60264. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016921.

The feasibility of a process employing ZnO in a spray dryer to remove simultaneously at least 90% of the SO_2 and NO/sub x/ from coal-fired combustion gases was studied. During this period, work began on cycling ZnO between absorption and regeneration to determine reactivity versus the number of heating cycles. There was a loss in ZnO reactivity after heating to 1400°F, but the bed was not stirred between cycles. A material balance accounted for recovery of about 70% of the absorbed SO_2 during regeneration, but only about 1.5% of the NO/sub x/. The latter may have been converted to N_2, N_2O, or other highly volatile compounds during the absorption step. The desorption curves for SO_2 and NO/sub x/ are in substantial agreement with previous DTA of a spent bed of ZnO. In part because of the lack of NO/sub x/ removal in the pilot plant experiments at PETC, two experiments were performed in Battelle's laboratory-scale spray dryer and baghouse. In one experiment, a 15 wt % slurry of ZnO was fed to the spray dryer; in the other experiment, the bags were precoated with ZnO and tap water was fed to the spray dryer. Excellent SO_2 removal was obtained in both cases, but the NO/sub x/ removal was low. However, experimental difficulties make the results questionable. It should be pointed out that the low NO/sub x/ removal was still better than the results at PETC where the NO/sub x/ removal was essentially zero.

43656 (DOE/PC/70266—1) Use of immobilized iron chelate catalysts for the combined removal of NO/sub x/ and SO/sub x/ from combustion flue gases. Final technical report, August 15, 1984-May 14, 1985. Case, G.D.; Dalal, N.S.; Calmon, C.; Gold, H. (Foster-Miller, Inc., Waltham, MA (USA)). 31 Jul 1985. Contract AC22-84PC70266. 100p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016122.

This report covers a laboratory-scale feasibility analysis on the use of immobilized iron chelate catalysts to simultaneously remove NO/sub x/ and SO/sub x/ from combustion flue gases. A large number of iron chelate wet absorption processes, mostly originating in Japan, have been implemented over the past 15 years, but were abandoned because of inefficient gas-liquid mass transfer, complex treatment and disposal of process by-products, and catalysts losses during blowdown or due to iron oxidation. The immobilization of iron chelates on a solid substrate would overcome many of the deficiencies encountered by the Japanese. Five metal chelate compounds were evaluated in aqueous phase tests and compared against an Fe-EDTA chelate, a catalyst used in some of the Japanese processes. The test chelates were selected to cover a wide range of bonding structures and oxidation-reduction characteristics relative to NO/sub x//SO/sub x/ removal. An iron phthalocyanine (FePc) catalyst was found to give enhanced NO mass transfer with a minimum of oxidation interference. The catalyst immobilization work focused on the absorption or binding of specified iron chelates to test substrates and the reactivity of each test material with nitrogen oxide and sulfur oxide derivatives. The most promising catalyst was FePc immobilized on a divinylbenzenechloromethyl polymer. This polymer is used as an intermediate in the synthesis of ion exchange resins. A loading of 4 percent by weight was achieved, which was stable against leaching in 0.1N acid media. Oxidation appears not to be a factor and its catalytic activity is adequate to support a process. The presence of dithionates, sulfates and nitrates in the by-products will greatly simplify by-product handling.

43657 **(DOE/RG/10312—2) Methodology for assessing solid waste disposal alternatives for future conversions to coal.** Kear, R.E.; Kittridge, J.C.; Waite, G.T.; Breitstein, L.; Udwari, J.J. (Dames and Moore, Bethesda, MD (USA)). Apr 1985. Contract AC01-80RG10312. 207p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85016997.

The objective of this study is to assist those considering conversions to coal, and those responsible for regulating solid waste disposal, in understanding and fully utilizing available solid waste reuse options. A case study analysis addressed solid waste disposal techniques and methods that were considered or employed by utilities having previously converted boilers to coal (with particular emphasis on those that required major modifications to do so), utilities operating coal fired boilers in states where future conversions are likely to occur, and recently constructed coal-fired powerplants and industrial facilities. By addressing the techniques and methods of byproduct management utilized at these facilities, the technical and institutional factors that influence the selection of a disposal method have been identified. These factors were compiled into a methodology for making decisions concerning byproduct management planning. This technical report details the results of the investigations undertaken and employed in developing this methodology, and presents a description of the byproduct management options and associated attributes and limitations of each. An appendix presents details on the case studies. Also provided as an appendix are summaries of interviews (conducted in Florida, Louisiana, Texas, and Oklahoma) with regulatory agencies, utilities, and other individuals knowledgable of byproduct management.

43658 **(EPRI-CS—4035) Continuous testing of the Resox process. Final report.** Gutterman, C.; Steiner, P. (Foster Wheeler Development Corp., Livingston, NJ (USA)). May 1985. 124p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920819.

The concept of an integrated flue gas desulfurization (FGD) system was tested by combining the front-end Wellman-Lord (W-L) SO_2-concentrating process with Foster Wheeler's RESOX process for producing sulfur. A 500-hour continuous test was completed in Foster Wheeler's 1-MW RESOX pilot plant using synthesized W-L feedstock. The major objectives - demonstrating a predictable performance and operating reliability - were successfully met. There were no long-term deleterious effects noted, and the average sulfur yield was within the predicted range of 75% +-10% (relative). An area that needs further development for RESOX commercialization to proceed is the adequate separation and collection of the sulfur product. 9 figs., 10 tabs.

43659 **(EPRI-CS—4153) Pilot study of Flakt-Boliden desulfurization process. Final report.** Keller, J.B.; Wright, F.M. (Stearns Catalytic Corp., Denver, CO (USA)). Aug 1985. 204p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920851.

This report summarizes test work performed on the Flakt-Boliden absorption/steam stripping flue gas desulfurization (FGD) process for the Electric Power Research Institute (EPRI). The Flakt-Boliden process employs a sodium citrate buffer solution to remove sulfur dioxide (SO_2) from gas. The scrubbing solution is regenerated by stripping with steam. The basic process was tested in a pilot plant of about 1 MW scale at Tennessee Vally Authority's (TVA) Colbert Power Plant. This report discusses the results of those tests. 8 figs., 13 tabs.

43660 **(GCA-TR—80-27-G(I)) Continuous emission monitoring for industrial boilers, General Motors Corporation, Assembly Division, St. Louis, Missouri. Volume I. System configuration and results of the operational test period. Final report.** Huckabee, D.; Diamond, S.; Porter, T.; McGlew, P. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Jun 1980. Contract AI01-80EV10473. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016811.

The objective of this program was to continuously monitor sulfur dioxide (SO_2) removal efficiencies of a flue gas desulfurization (FGD) system installed an industrial boiler for 30 days. The data will be used to substantiate the applicability of extractive monitors to industrial boilers and to aid in formulating New Source Performance Standards (NSPS) for industrial boilers. The monitoring program was conducted at the General Motors Corporation, Assembly Division, located in St. Louis, Missouri, during the period of December 27, 1979 through March 8, 1980. Sulfur dioxide (SO_2) and oxygen (O_2) concentrations were measured on a dry basis concurrently at both the inlet and outlet of the FGD system controlling the exhaust from one coal-fired boiler. Before commencing the monitoring program the analyzers were subjected to draft Performance Specification Tests (PST) delineated in 40 CFR 60 Appendix B, PST 2 and 3 proposed revisions, October 10, 1979. Throughout the 30-day program, abbreviated accuracy tests were conducted for both SO_2 and O_2 monitors and complete accuracy tests were conducted at the conclusion of the program. During the 30-day program, three simultaneous Method 5 particulate tests were conducted at the scrubber inlet and outlet. Component failure and electrical problems delayed the start date for monitoring from January 1, 1980 until February 3, 1980. Once these problems were rectified, the conditioning period was completed and the 30 days of data collection was begun. The report is contained in three volumes. Volume I is a compilation of the following: description of the combustion unit; description of the FGD system; description of monitoring data and process data acquisition, and data reduction; description of the monitoring program; description of the PSTs; results and conclusion of the PST and particulate tests; and quality assurance procedures.

43661 (PB—80124837, pp 173-190) **Coal refuse disposal practices and challenges in the United States.** Martin, J.F. (Environmental Protection Agency, Cincinnati, OH). Oct 1979. NTIS. (EPA—600-7-79-159).

In Proceedings of the second US-Polish symposium: coal surface mining and power production in the face of environmental protection requirements.

A review of coal refuse practices considers the resultant health hazards from spontaneous combustion releasing toxic fumes as well as respirable particulates. Feasibility studies concerning waste product utilization were also discussed as well as the economics of aluminium recovery.

43662 (PB—80124837, pp 43-52) **EPA enforcement and new source surface mining requirements and application in West Virginia, USA.** Wassersug, S.R. (Environmental Protection Agency, Philadelphia, PA). Oct 1979. Environmental Protection Agency, Corvallis, OR. (EPA—600/7/79-159).

In Proceedings of the second US-Polish symposium: coal surface mining and power production in the face of environmental protection requirements.

EPA's role in enforcing existing surface mine effluent limitations and monitoring requirements are discussed. In addition, proposed standards of performance for new source surface mines in West Virginia and compliance with EPA requirements are presented.

43663 (PB—80124837, pp 127-142) **Impact of surface mining and conversion of coal on ground water and control measures in Poland.** Libicki, J. (POLTEGOR, Wroclaw, Poland). Oct 1979. NTIS. (EPA—600/7-79-159).

In Proceedings of the second US-Polish symposium. Coal surface mining and power production in the face of environmental protection requirements.

Surface mining exerts an undesirable effect on the environment in general, and ground water in particular. The impact of coal surface mining on ground water is discussed in both quantitative and qualitative terms. The influence of coal surface mining of ground water quality is indirect and is due mainly to the storage of coal conversion and treatment wastes in old openpits. Recommendations are included for the classification of the wastes and methods of analyses of wastes for preliminary evaluation of their impacts on ground water. In addition recommendations are made for the classification and evaluation of disposals, as well as planning and designing of disposals. Monitoring systems designs and control work are recommended.

43664 **(EPA—600/S7-82-065b-Vol.2) Adipic acid enhanced flue gas desulfurization process for industrial boilers. Volume 2. Technical assessment. Project summary.** Behrens, G.P.; Hargrove, O.W. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). Mar 1983. Contract AI01-80EV10473. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016813.

The SO_2 removal efficiency with the adipic acid averaged 94.3% over a 30-day period, representing a significant improvement in the performance of the system using only limestone. Economic calculations for an industrial boiler adipic-acid-enhanced limestone FGD system indicate a slight reduction in both capital and operating expenses relative to a limestone-only system designed for 90% SO_2 control of 3.5% sulfur coal. The costs are competitive with the dual alkali system. The successful demonstration of the adipic-acid-enhanced limestone system increases the number of demonstrated technologies available to a potential user.

43665 **(EPA—600/S7-82-065a-Vol.1) Adipic acid enhanced flue gas desulfurization process for industrial boilers: Volume 1. Field test results. Project summary.** Clarke, P.A.; Gerstle, R.W.; Henzel, D.S.; Mason, K.W.; Sabatini, S.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). Mar 1983. Contract AI01-80EV10473. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016812.

Test results show that adding adipic acid to the limestone slurry significantly improved the SO_2 removal efficiency of the FGD system. Limited baseline data on operations with limestone only indicated a performance level of 55% SO_2 removal. Adding about 2200 ppM of adipic acid to the limestone scrubbing systems, the unit's level of performance increased to an average of 94.3% SO_2 removal which was maintained within a standard deviation of 2.2% over a 30-day test period during which boiler load was 70 to 130 million Btu/hr and gas throughput varied 300%.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 43637, 43642, 43643, 43920, 45105, 45106

43666 **(EPA/R—3-73-032) Fish and food organisms in acid mine waters of Pennsylvania.** Butler, R.L.; Cooper, E.L.; Crawford, J.K.; Hales, D.C.; Kimmel, W.G.; Wagner, C.C. (Pennsylvania State Univ., University Park (USA)). Feb 1973. 158p. GPO.

The three parts of this project relate respectively to the three objectives: develop a rapid and non-lethal bioassay for acid water using changes in utilization of cover and activity of fish, determine the effect of different levels of acid mine drainage on the presence or absence of fish populations in the watersheds of Pennsylvania, determine the median tolerance limits to low levels of pH of five aquatic insects chosen on the basis of their wide occurrence and common association in soft-water streams. Analysis of variance revealed there was no relationship between cover utilization and pH levels or between activity and pH levels for four species of fish (smallmouth bass, longnose dace, rock bass and brook trout). The failure of cover utilization and activity to reflect changes in water quality conditions makes this bioassay technique as tested unsuitable for the establishment of water quality criteria. In part II of the project it was found that common fish species normally distributed over several watersheds were absent where there was severe acid mine drainage. Of the 116 species of fishes found, 10 species exhibited some tolerance to acid mine drainage (values of pH 5.5 or less). An additional 38 species were found at pH values between 5.6 and 6.4 with the remaining 68 species at pH levels above 6.4. Severe degradation occurred at pH levels between 4.5 and 5.6. In part III all five aquatic species survived exposure for four days to pH levels from 6.5 to 4.0. The 96-hour TLm values ranged from 3.31 for the most sensitive animal, Stenonema sp., to 1.72 for the most tolerant insect, Nigronia fasciata.

43667 **(PB—85-193191/XAB) Guide for the use of organic materials as mulches in reclamation of coal-mine soils in the eastern United States. General technical report (final).** Slick, B.M.; Curtis, W.R. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 23 Apr 1985. 155p. NTIS, PC A08/MF A01.

Sponsored by Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.

The report provides information, recommendations, and guidelines for the use of organic materials as mulches in reclamation of coal minesoils in the Eastern United States. Includes a brief description of the environmental impacts of coal surface mining, the problems associated with disposal of organic wastes, and a discussion of mulch in relation to erosion, soil properties, and plant growth.

43668 **(PB—85-199784/XAB) Development of a remote coal dust deposition rate monitor. Open file report, 15 September 1978-31 August 1983.** Runstadler, P.W.; Dutta, P.K.; Hatfield, R.W.; Tenenbaum, R. (Creare Products, Inc., Lebanon, NH (USA)). Dec 1983. 123p. NTIS, PC A06/MF A01.

The report describes the design, development, and manufacture of a monitoring system to continuously monitor the buildup of float coal dust and rock-dusting materials in coal-mine workings. Ten dust sensors and two readout and switch-station units were built, performance tested, and calibrated.

43669 **(PB—85-206258/XAB) Draft environmental impact statement, Cummins Creek Project, Fayette County, Texas.** (Environmental Protection Agency, Dallas, TX (USA). Region VI). Apr 1985. 483p. (EPA—906/9-85/001). NTIS, PC A21/MF A01.

EPA is considering issuance of NPDES permits for the Cummins Creek Project. The surface lignite mine is proposed to provide fuel for two 400-MW steam-electric-generation units during the 37-year mine life. Notable effects associated with the project include: increased emissions of particulates, sulfur dioxide, nitrogen oxides, and radionuclides; degradation to surface water and groundwater quality; alterations in surface-water runoff, and groundwater infiltration; increased noise levels; increased erosion and loss of soils including prime farmlands; loss of cultural resources; increased tax revenues. Many of these project affects will result in adverse impacts and irreversible loss of natural resources.

43670 **(PB—80124837) Air pollution in the vicinity of large thermal power plants and control.** Pinko, L. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1979. vp. (EPA—600/7-79-159). NTIS.

The environmental impact of using coal as a fuel for power plants in Poland is discussed. As much as 95% of the electric power and about 100% of heat in Poland is generated by coal-fired plants. In this situation, the harmful emissions to the atmosphere produce many problems to be solved. Studies show that it is not so much the fly ash which accounts for the increased pollution level, as some of the elements occurring in the fuel, such as sulfur, and sulfur compounds. Some products generated in the burning process, such as nitric oxide also cause increased pollution and contribute to the serious toxic hazards to the environment. The results obtained from air pollution monitoring of several power plants in Poland are presented with emphasis on SO_2 concentrations and dust fallout deposition measurements. Air pollution prevention methods aimed at decreasing the environmental hazards are described.

43671 **(UCRL—93227) Changes in major organic contaminants in the groundwater at the Hoe Creek underground coal gasification site.** Wang, F.; Mead, W. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 13p. (CONF-8508101—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017278.

From 11. annual underground coal gasification; Denver, CO, USA (11 Aug 1985).

The results of groundwater analysis at the Hoe Creek underground coal gasification (UCG) site have indicated that, after gasifi-

cation, the phenolic compounds and neutral aromatic hydrocarbons decrease more slowly than expected on the basis of our laboratory studies. The field data also fail to confirm the expected inverse relationship between a contaminant's water solubility and the extent to which it is sorbed by surrounding coal. The authors described a mechanism for the deposition of coal pyrolysis products that may help to elucidate the observed behavior of these organic contaminants. 7 refs., 7 figs.

43672 **Evaluation of combustion turbine systems for the direct combustion of coal.** Berman, P.A.; Horazak, D.A.; Pillsbury, P.W. (Combustion Turbine Systems Division, Westinghouse Electric Corporation, Concordville, PA). *American Society of Mechanical Engineers, [Paper]*; 85-GT-8: 6(Mar 1985). (CONF-850351—).

From 30. international gas turbine conference and exhibit; Houston, TX, USA (18 Mar 1985).

A combustion turbine combined cycle that uses coal-derived dirty fuels can be economical if the fuel is processed at the plant site and cost of electricity (COE) is used as the criterion for configuring the power system and selecting its components. In a DOE/METC-sponsored study, 12 combinations of power components and conditioning components were evaluated for each of two fuels: a gas made from coal and a coal/water slurry. One baseline system was selected from each group of 12 systems, based on its potential to achieve a low COE. Each baseline system was then parametrically evaluated to show the effects of specific components on the COE of the power plant. In one of these studies, on-site coal conversion was shown as the key to reducing the COE and the operating cost of the plant, thus improving the chances of the plant being used for baseload operation.

43673 **Runoff water quality and hydrology at coal refuse disposal sites in southern Illinois.** Prodan, P.F.; Mele, L.M.; Schubert, J.P. (Argonne National Lab, IL). *University of Kentucky, Office of Engineering Services, [Bulletin] UKY BU*; 57-63(Dec 1982). (CONF-821175—).

From Symposium on surface mining hydrology, sedimentology, and reclamation; Lexington, KY, USA (1 Nov 1982).

Data on water quality and other hydrologic parameters were gathered from runoff at three abandoned, unreclaimed, coal-refuse disposal sites in southern Illinois. Two of the sites were subsequently recontoured, limed, covered with 30 cm of glacial till and loess, fertilized, and seeded. Data collected one to four years after reconstruction of these sites indicated that 1) runoff rates were increased because the soil cover was less permeable than the coal refuse and 2) acidity, sulfate, and metal concentrations in surface runoff waters were greatly reduced following renovation. However, gradual increases in acidity, sulfate, and metal concentrations in runoff water at one of these sites were seen two years after reconstruction, and these concentrations may continue to rise in the future. This indicates that the pyrite and iron sulfate salts in the coal refuse will make reclamation a gradual and long-term process, rather than one that can be carried out quickly by grading, liming, and covering with soil.

43674 **Summary of health and environmental research: coal gasification.** Wilzbach, K.E.; Reilly, C.A. (Argonne National Laboratory, Argonne, IL). pp 31-54 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

This chapter summarizes coal gasification health and environmental research sponsored by the U.S. Department of Energy and conducted by Argonne National Laboratory, the Inhalation Toxicology Research Institute, and Oak Ridge National Laboratory. Following an overview of coal gasification technology and its related health and environmental concerns, the results and conclusions in areas of potential concern are summarized. Emphasis is on chemical and toxicological characterization of materials from a range of process streams in six bench scale, pilot plant, and industrial gasifiers. Ecological effects, industrial hygiene, and environmental control technology performance are also addressed.

43675 **Laboratory-scale simulation of coal gasification for biological studies.** Mixon, F.O.; Cleland, J.G.; Gangwal, S.K.; Green, D.A.; Hughes, T.J. (Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709). pp 199-227 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Comparison of operating data from a laboratory-scale coal gasification unit with similar data from large-scale units indicates that the laboratory-scale unit can be a valuable tool in predicting environmental effects of commercial units. A statistical correlation of data on more than 50 operating runs shows that pollutant production in the tar phase is strongly dependent upon coal rank, coal nitrogen content, coal sulfur content, and coal volatile content. Tar base and polynuclear aromatic production as well as the response to Ames testing appear to be related primarily to fuel sulfur content and nitrogen content. This chapter examines cause-effect relationships that seem to exist among feedstock characteristics, gasifier operating parameters, pollutant production, and bioassay results from gasifier effluents. Mutagenicity of tars and their fractions is emphasized.

43676 **Extrapolation to health risk: use of comparative approaches.** Morris, S.C.; Barnacik, J.I.; Fischer, H.; Hamilton, L.D.; Jones, S.; Moskowitz, P.D.; Nagy, J.; Rabinowitz, S.; Thode, H.C. (Brookhaven National Laboratory, Upton, NY). pp 323-341 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

This is a preliminary report of work in progress to estimate cancer induction in the general population from an indirect coal liquefaction plant at an eastern U.S. site. Emissions are grouped into risk assessment categories to simplify the task of dealing with many different chemical compounds. Effects are estimated from exposures via air, surface water, and terrestrial and aquatic food chains. Dose-response functions for cancer are extrapolated from animal data by techniques previously used for food and pesticide exposures. This chapter demonstrates the approach for a single health effect, cancer, and for a single risk assessment category, polycyclic aromatic hydrocarbons.

43677 **Interactions between dissolved humic materials and organic toxicants.** Stewart, A.J. (University of Oklahoma, Biological Station and Department of Botany and Microbiology, Kingston, OK). pp 505-521 of Synthetis fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Dissolved humic materials (DHM) are important constituents of the dissolved organic carbon pools in most lakes and streams and often occur in concentrations of 5 to 50 mg/L. DHM exists as a heterogeneous complex with a molecular weight spectrum of a few hundred to many thousands. The molecular weight spectrum of DHM is clearly dependent upon environmental factors (pH, ionic strength of the medium, light intensity, etc.), and differential shifts in the molecular weight spectrum of DHM will alter the types of reactions that predominate between DHM and organic toxicants. However, quantitative data regarding seasonal shifts in the molecular weight spectra of DHM in different lake or stream types are unavailable. DHM bears electron-acceptor and -donor groups and possesses stable free radicals; these features enhance DHM chemical reactivity. In the presence of sunlight, DHM generates singlet oxygen ($^1O_2$) from ground-state dissolved oxygen; $^1O_2$ is extremely reactive and promotes both the alteration of organic toxicants and the formation of peroxides. High-molecular-weight DHM demonstrates colloidal properties and can adsorb relatively insoluble pesticides; the transport and fates of the adsorbed toxicants are subsequently modified to an unknown extent. The toxicities of selected organic compounds were assessed in the presence and absence of a

low-molecular-weight DHM using an acute (4-h) algal bioassay. When DHM was present, compounds in an aniline methylation series became more toxic (1.1- to 40-fold). DHM similarly increased the toxicity of o-cresol, 2,4-dimethylphenol, and 2,3,6-trimethylphenol (2- to 5.4-fold) but reduced toxicity of p-benzoquinone and quinoline by factors of 6.1 and 1.2, respectively. Evaluation of the importance of DHM to the transport, fate, and ecological effects of organic toxicants will be greatly enhanced by recent trends in methodology, several of which are discussed.

43678 Summary of health and environmental research: coal liquefaction. Gray, R.H.; Mahlum, D.D.; Strand, J.A.; Weimer, W.C. (Coal Liquefaction Environmental Research Program, Pacific Northwest Laboratory, Richland, WA). pp 13-30 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

This chapter summarizes health and environmental research (1976 to present), supported by the U.S. Department of Energy, to assist in the development of environmentally acceptable coal liquefaction processes. Four major direct coal liquefaction processes have been evaluated: SRC-I and -II (solvent-refined coal), H-coal (catalytic), and EDS. Short-term bioassays were used to screen coal-derived materials for possible health and environmental effects. Longer-term bioassays were used to evaluate materials considered most representative of potential commercial practice and with greatest possibility for human exposure or release to the environment. Detailed chemical analyses were used to identify compounds and classes of compounds responsible for biological activity. Effects of process modification, control technologies, and changing operational conditions on potential health and environmental effects are also being evaluated. Significant research results are described.

43679 Summary of health and environmental research: solid waste management. Francis, C.W.; Wobber, F.J. (Oak Ridge National Laboratory, Oak Ridge, TN 37831). pp 111-136 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Research results pertaining to potential health and environmental consequences of solid wastes produced by operating commercial-sized coal conversion plants were reviewed and evaluated. Some of these wastes contain toxic metals as well as mutagenic and carcinogenic organic compounds. The major problem, however, is not the acute toxicity or carcinogenicity of the wastes, but rather the generation of solid waste leachates from the large volume of wastes, predominantly coal preparation wastes, gasifier ashes, and slags. The most troublesome wastes appear to be those containing reduced forms of sulfur. When disposed of in landfills, these wastes will, with age and oxidation of sulfur, generate acidic leachates. These leachates will likely contain concentrations of toxic contaminants such as copper, lead, cadmium, and nickel that will overtax natural attenuation or dispersal mechanisms, resulting in their harmful accumulation in surface and groundwater as well as in other sensitive areas of the environment. Some of the organic wastes, such as electrostatic precipitator tars and oily sludges from wastewater treatment, are potential health hazards relative to their exposure at the coal conversion facility and to their handling en route to disposal sites. Further health and environmental research is needed to identify the risks associated with exposure to the work force as well as exposure to the general population because of landfill disposal practices. Health research should concentrate on investigating the effects of inhalation, contact with skin, and ingestion of wastes. Environmental research should address questions regarding long-term disposal. The major research goal should be the prediction of solid waste leachate movement in subsurface environments.

0110 Reserves And Exploration

43680 (DOE/ET/14692—T11) Peat resource estimation in Minnesota. Third quarter report, FY1985. (Minnesota Dept. of Natural Resources, St. Paul (USA). Div. of Minerals). [1985]. Contract FG18-79ET14692. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016115.

The Minnesota Department of Natural Resources has been surveying organic soil deposits to determine the location of fuel-grade peat since October 1, 1979, when the US Department of Energy and the Gas Research Institute awarded Minnesota a grant for peat resource estimation. The survey determines the type, quantity, and energy potential of peatlands by field mapping and laboratory characterization. The focus of the project is an eight-county study area (Aitkin, Beltrami, Carlton, Cass, Itasca, Koochiching, Lake of the Woods, and St. Louis counties) that contain over half of Minnesota's six or seven million acres of peatland. Approximately one million acres of the state's total peatland acreage are currently available for state lease. The Koochiching County survey (1,147,560 acres of peatland), the Aitkin County survey (420,560 acres of peatland), and the survey of an area of Beltrami and Lake of the Woods counties (775,400 acres of peatland) have been completed, and the reports have been published. A reconnaissance-level peatland survey of southwest St. Louis County was completed, and a report was published with state funding. Our staff is continuing the redrafting of the Carlton County Peat Resource Map to correct registration errors. We expect the redrafted version of map to be completed in the fourth quarter. The computerized version of the map will be started when the redrafting is complete.

0120 Mining

REFER ALSO TO CITATION(S) 43705, 43706

43681 (CDF-SA—1983) Houilleres de France Annual statistics 1983. (Charbonnages de France, 75 - Paris). 1983. 56p. (In French). NTIS (US Sales Only), PC A04//MF A01. File Number DE85750562.

This "annual statistics" presents, as previous years, the essential data on the activity of Houilleres de France: coal mining; the market; the social situation; the financial situation; conversion industries and balance of collieries.

43682 (DOE/EV/06660—T1) [National Coal Policy Project]. Mining Task Force report submitted for review by the plenary, September 26-27, 1979. (Georgetown Univ., Washington, DC (USA)). 1979. Contract FG01-78EV06660. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85012409.

Since the plenary session in January, the Mining Task Force has met seven times. In April, the Task Force decided to break into two subgroups to discuss the separate issues: federal coal leasing policy and implementation of the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA). The subgroups met on three occasions separately, and four meetings included the whole Task Force. In August, the Task Force reached a consensus with recommendations on four separate issues related to implementation of SMCRA: (1) criteria for evaluating variations in state program regulations under the "state window" provisions of OSM's permanent program regulations, (2) public funding for enhancing citizen involvement in regulatory programs, (3) technical assistance to small operators, and (4) abandoned mine reclamation programs. These recommendations are attached and the Mining Task Force requests approval from the Plenary to distribute these recommendations to state agencies that are presently developing state regulatory programs, the Office of Surface Mining and other interested parties. The Mining Task Force was unable to reach agreement on any issues related to coal leasing policy. The attached paper discusses the issues that were discussed by the coal leasing subgroup, and examines some of the reasons no agreement was reached. A separate statement by the Environmental side of the Federal Leasing Subgroup is attached at the end of this report. The Mining Task Force recommends that no further efforts be made in this area.

43683 (DOE/FE/00016—T82) Refinement and evaluation of basic longwall dust-control techniques. Final report, July 1981-December 1984. Kost, J.A.; Colinet, J.F.; Shirey, G.A. (Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.). Feb 1985. Contract AI01-81FE00016. 251p. NTIS, PC A12/MF A01; GPO Dep. File Number DE85016585.

The contract objective was to evaluate the effectiveness of available dust-control technology for double-drum shearers. Eight underground surveys were conducted to evaluate drum design, drum spray nozzle locations, ranging-arm sprays, water quantity, wetting agents, and cutting techniques. The final report is made up of eight dust-control technique reports, each discussing details of the individual mine surveys. 114 refs., 37 figs., 40 tabs.

43684 (PB—85-193449/XAB) Comparative laboratory evaluation of resin-grouted roof bolt elements. Report of Investigations/1985. Bartels, J.R.; Pappas, D.M. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 27p. (BM-RI—8924). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-600267.

In laboratory testing, the Bureau of Mines established criteria by which common resin-grouted roof-bolting systems can be evaluated and compared. Ultimate strength and stiffness were determined for nontensioned full-column, point-anchor, tensioned full-column, and debondable resin-grouted bolts, and for variations on full-column bolts. Bolt performances were compared using the performance of the 3/4-in full-column resin-grouted bolt as the standard. New and innovative systems can also be qualitatively compared against this standard. Various host mediums were used in the testing: sandstone, concrete, simulated coal, simulated shale, and plaster. Bolt performances expected in other mediums can be inferred from the response patterns obtained in these mediums.

43685 (PB—85-193787/XAB) Influence of continuous-miner bit sharpness and coal-lithotype composition on coal breakage: examples from Kentucky mines. Technical report. Lineberry, G.T.; Rogers, F.D.; Leonard, J.W.; Hower, J.C.; Graese, A.M. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). 1985. 394p. (IMMR—84-121). NTIS, PC A17/MF A01.

Sponsored by Kentucky Energy Cabinet, Lexington.

This pilot study addresses the influence of coal lithotype, continuous miner bit sharpness, and coal hardness on particle sizing and liberation characteristics. The interface of the job end of the traditional continuous mining machine and the given geologic conditions at the job site; and their combined influence on particle sizing and liberation is investigated.

43686 (PB—85-197242/XAB) Safety aspects of pneumatic transport. Information Circular/1985. Bowers, E.T. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). 1985. 44p. (BM-IC—9006). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-600211.

The work reported here deals with the safety aspects of pneumatic transport of underground coal, as well as the hazards inherent in more conventional haulage systems. Included are three designs for different applications of pneumatic haulage: off-loading a continuous-mining machine on a room-and-pillar section, vertical hoisting through a 1,200-ft shaft, and off-loading a tunnel-boring machine driving a 2,000-ft tunnel.

43687 (PB—85-198588/XAB) Device for in-situ measurement of coal-cutting forces. Report of Investigations/1985. Church, J.C. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1985. 32p. (BM-RI—8925). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-600212.

The Bureau of Mines devised and demonstrated a portable linear-cutting tester that directly measures and records the in-situ cutting forces required of continuous-mining machine picks to cut coal in underground mines. It requires only two operators to transport and operate the tester, which can be assembled and operated through a complete test cycle within a single mine work shift. This report reviews the factors considered in the design and development of the tester and the results of its system verification testing at coal mine sites.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 43685, 43697, 43699

43688 (CONF-8405346—) Report on solids transport workshop. (USDOE Pittsburgh Energy Technology Center, PA). May 1984. 78p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016428.

From Solids transport workshop; Pittsburgh, PA, USA (8 May 1984).

As the United States increases its capability to utilize all of its natural resources, the ability to predict behavioral flows of solids or liquids in transport systems is becoming increasingly important. This is largely due to the introduction of new, complex synthetic fuel processes for coal gasification, liquefaction, and shale retorting, and the introduction of new transport methods in coal utilization processes. As a result, future development in solid transport systems rely heavily on today's efforts to understand, describe, and predict flow behavior; the ability to define character of materials; the ability to advance current numerical methods; and the ability to develop theoretical and computer simulation models. At present time, methods being used to meet solid transport needs in major energy production and resource recovery facilities have increasingly been demonstrated to be technically inadequate resulting in overly expensive installations. Solid transport systems require substantial improvements to reduce existing deficiencies in solids handling, instrumentation, components, and processes. Specifically, problem areas identified with solid transport systems not only include the lack of necessary theoretical and experimental research activities, but also include the lack of a general understanding of the fundamental factors which control solids transport. Such fundamental factors include coal properties, vehicle properties, and system parameters. In the latter case, the current state of knowledge precludes prioritization.

43689 (DOE/PC/50270—T8) Coal water mixture development. Quarterly technical progress report. (TRW, Inc., Redondo Beach, CA (USA)). 31 Jul 1984. Contract AC22-82PC50270. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015584.

Although receipt of five of the six screening test slurries was scheduled during this quarter, difficulties encountered in producing acceptable CWMs resulted in delays in slurry delivery and testing. A generic slurry and the first two test slurries have been received from Vendors A and C. Shakedown of the plant with generic slurry has been completed. Screening testing of the two test slurries has also been completed. The generic and Test Slurry No. 2, both from Vendor A, exhibited severe gas entrainment after pumping 180 cycles, approximately 24 hours, through the test loop. Vendor C slurry performed as planned. Analysis of the hydraulic data obtained from operation with Vendor C slurry indicates that existing correlations are applicable. An equipment failure occurred in testing Vendor A slurry which involved the twin screw burner pump seals. Preliminary assessment places the cause on inadequate supply of CWM to the pump resulting in "dry pumping," as evidenced by pump suction pressure while pumping Vendor A slurry. Engineering calculations indicate that replacement of 3-inch with 6-inch pump suction lines will assure an adequate supply of CWM to the pumps to avoid dry pumping. 5 figs., 2 tabs.

43690 (DOE/PC/50270—T9) Coal water mixture development. Quarterly technical progress report. (TRW, Inc., Redondo Beach, CA (USA)). 13 Oct 1984. Contract AC22-82PC50270. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015585.

Equipment screening and hydraulic data acquisition has been completed for three of the six coal water mixtures for testing in this phase of the project. In addition, an initial slurry was evaluated as a part of the shakedown of the test loop plant. This initial slurry and two of three screening slurries were prepared by slurry Vendor A, while test slurry No. 1 was prepared by Vendor C. The Vendor C slurry is lower in initial viscosity than the Vendor A slurry, shows

little viscosity increase upon multiple recycle in the test loop plant, does not stratify in the storage tank and gives acceptable pump performance. The Vendor A slurries stratify in the storage tank, sometimes form a non-suspendable slurry component on the bottom of the tank, are more difficult to unload from the storage tank, form a gas-liquid dispersion after a few hours of use in the test loop and tend to cause cavitation in the suction end of the burner pumps when transported through the then 3 inch burner pump suction line. It was concluded that Vendor A slurry would not be operable in the test loop plant with its 3 inch burner pump suction line and that change out of the lines to 6 inch would enhance the possibility of testing of Vendor A slurry for the planned 44 hours per charge. Thus, there was a choice available to either discontinue testing of future Vendor A slurries or make the indicated piping modifications. The Department of Energy suggested that it would be preferable to modify the plant and to evaluate the effect of the modifications on the behavior of the remaining Vendor A slurry. Therefore, at the conclusion of the testing of slurry No. 3, the 3 inch portion of the test loop was disassembled and replaced with 6 inch pipe together with associated valves and isolation spools. The plant is now ready for completion of the screening of the final three slurries.

43691 **(DOE/PC/70778—T4) Measurement and control of electrostatic charges on solids in a gaseous suspension. Technical progress report No. 4.** Nieh, S.; Nguyen, T.; Lee, S.W. (Catholic Univ. of America, Washington, DC. Dept. of Mechanical Engineering). Jul 1985. Contract FG22-84PC70778. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015498.

Measurement of mean particle charges and charge distributions on glass beads in a 2-inch grounded copper pipe loop have been made under various combinations of air humidities, conveying velocities and particle sizes. Air humidity was shown to have significant effects on particle charges. The charges become effectively below the minimum detectable level (3×10^{-14} coulomb) when the relative humidity is above 80%. A linear relationship between mean particle charge and relative humidity was correlated. The particle charge distribution at low humidity or high conveying speed is characterized by a wide spectrum and a large mean charge, while at high humidity or low velocity, the width of the distribution narrows with its peak shifting toward the small charge range. Large particles carry a large mean charge and a small mean charge-to-mass ratio as expected. A significant finding was that the mean surface charge density remained almost constant over a wide range of particle size. 9 refs., 8 figs., 3 tabs.

43692 **(DOE/PC/72007—T5) Ultra-fine coal characterization. 5th quarterly report, March 1-May 31, 1985.** Smit, F.J.; Odekirk, J.R. (AMAX Extractive Research and Development, Inc., Golden, CO (USA)). 26 Jun 1985. Contract AC22-84PC72007. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017161.

This report covers the fifth quarter of activity characterizing the mineral-matter liberation and the beneficiation of ultra-fine coal. Bulk properties of two additional coals - Indiana III and Illinois No. 5 - are reported and comparisons made between washability test results and automated image analysis/energy dispersive X-ray (AIA-EDX) determinations for liberation. Zeta potential and contact angle measurements were also made to characterize surface properties. 6 refs., 9 figs., 9 tabs.

43693 **(NYSERDA—85-7) Technical/economic impacts and implications of using washed coals at New York State utilities. Final report.** Holt, E.C. Jr.; Jaffeson, R.C.; Hoffman, L. (Hoffman-Holt, Inc., Silver Spring, MD (USA)). May 1985. 415p. NYSERDA, Two Rockefeller Plaza, Albany, NY 12223. File Number TI85901508.

In an effort to develop a working document focusing on many of the issues of importance to reshaping a strategy of greater energy independence, the New York State Energy Research and Development Authority (ERDA) initiated this program to consider the impacts of coal washing at NYS utilities. This report addresses the general topics of relevance listed below. (1) NYS generation capacity and coal requirements through 1996 along with an assessment of suitable coals which are geographically situated within economic transportation distances to current and future coal-fired plants. (2) Coal cleaning technologies which are currently or potentially available to reduce the ash and sulfur contents of coals suitable for NYS utilities. (3) Techniques for evaluating the amendability of certain coals to being efficiently cleaned by conventional processes and their associated costs. (4) The economic and environmental impacts of varying coal quality on operations and costs at utility plants. (5) A historical assessment of the actual influence of coal quality at a NYS utility. (6) Methodology and procedures for applying economic significance to the costs and benefits associated with alternative qualities of coal, including those which have been physically cleaned. (7) A practical means of establishing a procedure for measuring the actual impacts of changes in fuel quality at coal-fired utility plants. 39 figs., 84 tabs.

0140 Combustion

REFER ALSO TO CITATION(S) 43693, 44922

43694 (CONF-8205275—, pp 66p, Paper 6) **Development of atmospheric fluidized bed combustion (FBC) boiler technology for power generation in Japan.** Takagi, M.; Tamura, A.; Shikata, T. 1982. NTIS (US Sales Only), PC A09/MF A01. File Number DE84901602.

From Meeting on potential applications of fluidized bed combustion in Canadian industry; Calgary, Canada (27 May 1982).

The following topics are discussed: present and future of coal-fired power generation in Japan, environmental regulation by the government and pollution control by electric power utilities, significance of developing the FBC boiler for power generation businesses, the 20 t/h FBC boiler pilot plant, and future prospects.

43695 **(DGRST—80-7-0173) Atmospheric pressure fluidized bed coal combustion test.** Meysson, N.; Grue, B. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). Jun 1982. 186p. (In French). NTIS (US Sales Only), PC A09. File Number DE85751286.

A pilot plant is realized for the combustion of coal in a fluidized bed at atmospheric pressure, with a bed cooled by immersed exchangers. Technological devices and the associated operating conditions are developed. In particular, pre-heating of the bed, introduction of coal into the bed and control of variations in the load are examined. A technico economic evaluation shows that the process could be interesting only if desulfurization is required.

43696 **(DOE/ET/00241—T7) Feasibility testing of micronized coal: oil (MICO) fuel in a model gas turbine combustor.** Vranos, A.; Knight, B.A.; Sangiovanni, J.J.; Boedeker, L.R.; Seery, D.J. (United Technologies Corp., East Hartford, CT (USA). Research Center). May 1979. Contract AC22-78ET00241. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85014947.

A preliminary investigation has been made of the combustion characteristics of micronized coal-oil (MICO) slurry fuel sprays and individual droplets. The bulk of the testing was done in a model combustor for the purpose of characterizing particles in the combustor exhaust. In gas turbine applications, these particles must not agglomerate and must remain smaller than a few microns in order to minimize turbine blade erosion. The model combustor employed a variable swirl burner and was specifically constructed at UTRC for use with alternative fuels. The MICO fuel was supplied by DOE for this study and was 32% by weight Pittsburgh seam coal in diesel fuel. A promising result from this work is that particle agglomeration does not appear to occur. However, combustion efficiency was lower than expected. Gas and particulate sampling were performed with MICO hydrid fuel over the range of fuel flow 9-11 cc/sec, fuel/air ratio f/a = 0.06 to 0.095. Gas samples showed typically 10% O_2, 10% CO_2, less than 0.1% CO, and 100 to 200 ppM NO/sub x/, and were not a strong function of radial flame position. Combustion efficiency was about 50%. Scanning electron micrographs of particulate samples show the presence of individual, nonagglomerated particles of various characteristics. A variety of molten, devolatilized, porous, swollen and partially burned out coal particles were found. Traces of Fe, Al, S, Cl, K, Cu, and Ti were identified in the samples with an x-ray microprobe. Calculations suggest that, at present conditions, radiation

loss from particulates is a significant factor in limiting burnout of coal. Further experiments to improve flame intensity and efficiency with present MICO fuel are required.

43697 **(DOE/FC/10614—1902) Fundamental combustion studies of low-rank coal slurries. Quarterly technical progress report No. 5, March 1, 1985-May 31, 1985.** Germane, G.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 15 Jun 1985. Contract AC18-84FC10614. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017289.

This contract for fundamental combustion studies of low-rank coal slurries was initiated March 1, 1984. Slurries being studied are primarily those produced from steam-dried lignite coal provided by the Grand Forks Project Office. Contract work includes virgin coal and slurry characterization, slurry spray and atomization measurements, detailed mapping of combustion products and pollutants for low-rank coal slurries in a laboratory reactor, and comparison of results with computer model predictions and with data obtained under similar conditions from combustion of high-rank coal-water mixtures. Progress reports are presented for the following three tasks: (1) coal slurry characterization; (2) coal slurry spray characterization; an (3) coal slurry combustion tests. 11 refs., 3 figs., 1 tab.

43698 **(DOE/PC/50270—T10) Coal water mixture development. Quarterly technical progress report.** (TRW, Inc., Redondo Beach, CA (USA)). 6 Apr 1983. Contract AC22-82PC50270. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015582.

The Plant Equipment and Performance task of the Coal Water Mixture Development program has been underway for six months. During that time TRW has planned and scheduled a 36 month program which will meet the goals and objectives of the project. Through the design, construction and operation of subscale test plant simulating the fuel feed system to industrial and utility boilers, a data base will be generated which will allow industrial users to develop designs for full scale boiler installations. The preliminary design and equipment selection for the test plant continued during the second quarter with the development of engineering requirements and several revisions of the P & I drawings. Contacts with equipment suppliers continued during the second quarter which will lead to the development of an equipment list. Preliminary analyses of expected hydraulic performance of CWM's in the test loop have been developed in order to specify and size equipment. Third quarter plans include the completion of the design effort and the start of procurement, fabrication, and installation activities.

43699 **(DOE/PC/60408—T2) First workshop on biomass and coal conversion programs of the USAID/GOI Alternative Energy Resources Development Project. Report on trip to India, November 7-19, 1983.** (Viking Energy Corp., Pittsburgh, PA (USA)). 1983. Contract AC22-83PC60408. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017294.

The intent of the workshop was to provide a forum for a technical exchange between the US and Indian specialists in specific areas of interest in coal/biomass conversion. The meeting also served the objective of acquainting each side with regard to the "State of the Art" and ongoing research and development activities in the US and India. Work plans were developed and modified for implementing the selected projects. At the end of the workshop site visits were made to assess the facilities and equipment and meet the technical personnel available to carry out the proposed projects. Six projects were selected for collaboration in coal conversion and three in biomass conversion. The six coal projects are: Evaluation of Freeboard Performance in a Fluidized Bed Combustor; AFB Boiler Scale-Up; Hot Gas Cleanup; Cold Gas Cleanup and Separation; Rheology, Stability, and Combustion of Coal-Water Mixtures; and Coal Beneficiation. The three major biomass conversion projects are: Development of a village-level gasifier (5 hp for irrigation pumps based on charred agricultural residue); Utilization of producer gas in small horsepower (3 to 5 hp) utility engines; and Development and field implementation of small wood-based gasifier-engine systems (5 30 30 hp).

43700 **(DOE/PC/70770—4) Fundamental studies of the mechanisms of slag deposit formation.** Austin, L.G.; Tangsathitkulchai, M.; Gomez, C.; Malchenson, D.; Benson, S. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). Jun 1985. Contract FG22-84PC70770. 73p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016182.

A laboratory test furnace was used to investigate the slagging tendencies of pulverized coal under conditions which simulate the combustion conditions in a full-scale boiler. The accomplishments during this reporting period include: (1) Preliminary results of tests using polymer-mineral mixtures have shown that the deposits produced are similar in morphology to deposits produced from coals. (2) Temperature profiles in the region bewteen the constrictor and the substrate were determined by the use of pyrometric cones. (3) The performance of the fluidized spouting-bed feeder was tested to determine whether it was feeding a representative sample of coal. (4) Quantitative SEM-microprobe analysis was performed on a cross-section of an Indian Head lignite ash deposit. The results showed trends in composition with respect to height and distance from the centerline to outer edges of the deposit. Development work has continued on the computer-controlled SEM system. The sintering characteristics of Beulah and Upper Freeport fly ashes were examined. The compressive strength and shrinkage of the Beulah fly ash remained essentially unchanged with time at heat treatment temperatures below 1150°C, whereas significant changes in compressive strength and shrinkage occurred in the sintering of the Upper Freeport fly ash. Strength tests of the HF-washed Upper Freeport fly ash were performed to verify the hypothesis that glassy phases in fly ash promote deposit strength. In addition, sintering studies on a model system consisting of a soda glass and alumina mixture were performed to illustrate the viscous flow mechanism of sintering. 11 refs., 29 figs., 7 tabs.

43701 **(DOE/PC/70794—3) Effect of energy feedback mechanisms on the oxidation rate of pulverized coal. Quarterly technical report.** Choi, S.; Haussmann, G.; Kruger, C.H. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Jun 1985. Contract FG22-84PC70794. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015388.

This research program has as its objective the understanding of energy feedback from burning volatiles surrounding pulverized coal particles as a fundamental mechanism of coal oxidation, and the assessment of the applicability and limitations of this mechanism for varying coal combustion environments. During the previous project periods, a set of reactor tests have been performed in which oxidation reactivities were measured and newly developed diagnostics were implemented. Through these tests a complete test sequence has been completed where the major reaction variables (gas temperature, oxygen concentration, and particle size) have been parametrically studied. Results of cross section micrography are presented in Chapter 3 of this report, and interpretation and discussion of the reactor tests are summarized in Chapter 4. 32 refs.

43702 **(EPRI-AP—4063) Critical component technologies for stationary gas turbine catalytic combustors. Final report.** Pillsbury, P.W. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Aug 1985. 164p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920806.

The objective of this combustion turbine burner research effort was to obtain initial experimental data regarding significant component technologies needed for applying catalytic combustion to oil-fired, utility combustion turbines. The two principal technologies subjected to testing were: fuel/air preparation upstream of the catalyst; and transfer between primary, and primary-plus-secondary operating modes, where secondary refers to fuel for the catalytic element. Another technology involved, but investigated more briefly, was preburner (primary) design. An existing Westinghouse 14 in. (35.6 cm) diameter catalytic combustor was modified to resemble the recommended design in basic arrangement as developed under the EPRI Research Project 1657-1. It was tested during 17 hours and 40 minutes of fired combustion over three test days. Temperatures, pressures, and air velocities equalled projected

engine conditions; air flows were reduced, because the existing test combustor was 87.5% of the diameter of the recommended engine design. The catalytic elements used in this series were of the latest Engelhard Industries design, incorporating a platinum metals group catalyst on a high-strength NGK magnesium aluminum titanate substrate. Nozzle-to-nozzle fuel distribution emerged as a key variable in improving fuel-air preparation zone performance. The key to successful fuel transfer is beginning to appear as successful steady state combined operation, rather than the method of manipulating the valves. 7 refs., 76 figs., 15 tabs.

43703 **(EPRI-CS—4028) Pressurized fluidized-bed combustion power plants: proceedings.** (Meeting Planning Associates, Menlo Park, CA (USA)). May 1985. 626p. (CONF-8406269—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920781.

From Pressurized fluidized-bed combustion power plants; Williamsburg, VA, USA (20 Jun 1984).

EPRI and Florida Power & Light Company cosponsored a utility conference on Pressurized Fluidized-Bed Combustion power plants for use in central generating stations. The meeting was held June 20-22, 1984 in Williamsburg, Virginia. Twenty-seven papers, presented in nine sessions, covered topics ranging from user and vendor market perspectives to current thinking in PFBC boiler design to recent results from most of the world's PFBC pilot plants. These proceedings contain the technical and economics papers presented at the conference and the opening and closing remarks by EPRI and Florida Power & Light. The two principal objectives of the conference were to: Provide a forum for direct exchange of information between potential vendors of PFBC equipment and potential users of PFBC generating technology; and disseminate to US and Canadian utilities the latest results from recent PFBC activities in the US and Europe. The expressed level of interest in PFBC as an alternative generating technology was higher at this conference than at any preceding conference sponsored by EPRI. Thirty utility personnel from seventeen utility companies attended. Papers have been entered individually into EDB and ERA. (LTN)

43704 **(MIT/EL—84-004WP) Ignition and combustion of utility grind coal-water slurry in a lean, confined, turbulent diffusion flame.** Walsh, P.M.; Zhang, M.; Farmayan, W.F.; Beer, J.M. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Nov 1984. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017260.

A coal-water slurry (CWS) designed for boiler firing typically contains 30 wt % water. Although the heat required to vaporize this water is only a small fraction of the overall heat of combustion, it approximately doubles the heat required for ignition of the coal particles. The additional time and distance needed to vaporize the water before ignition of the coal residues is detrimental to the stability of CWS flames. In order to assess the importance of this effect, measurements of gas velocities, temperatures, and oxygen mole fractions were made near the burner during combustion of CWS in a confined turbulent diffusion flame. The trajectories and temperature histories of 10 to 100 μm slurry droplets injected into this flow were calculated using a one-dimensional model. The distances required for vaporization of water, ignition, release of volatiles, and char burnout were then estimated. Consistency of the procedure was checked by comparison of calculated and measured temperature and oxygen profiles. The heat for ignition of the spray is supplied by entrainment of hot combustion products into the fuel and air jets, and from combustion of the volatiles and char residues of the smallest droplets. The droplet velocity leaving the atomizer, and the gas velocity in the region of the fuel spray have important effects on the spatial distribution of ignition and combustion through their determination of the droplet trajectories. The presence of 32 wt % water in a slurry droplet results in an increase of about 50% over the distance required for ignition of an equivalent coal particle under the conditions in the flame. 34 refs., 11 figs., 6 tabs.

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0150 Marketing And Economics

REFER ALSO TO CITATION(S) 43615, 43681, 43693, 44506

43705 **(CDF-RA—1982) 1982 progress report for Charbonnages de France.** (Charbonnages de France, 75 - Paris). 1982. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750561.

This progress report of Charbonnages de France reviews, and analyses data, of 1982 presented in tables in the following fields: 1) Charbonnages de France and the energy market; 2) Productions of Charbonnages de France; 3) The personnel; 4) To prepare tomorrow; 5) Subsidiary companies.

43706 **(DOE/PC/72268—T3) Virginia coal industry: a study of the infrastructure. Final technical report.** Hibbard, W.R. Jr.; Chisholm, R.H.; Valdes, R.M. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research). Jul 1985. Contract FG22-84PC72268. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016192.

The Virginia coal industry was studied in the context of the Central Appalachian coal markets and competitive coal sources from eastern Kentucky and West Virginia. Production, transportation, and marketing were evaluated, focusing on delivered cost to the user as the key issue in sales. The study concludes that since coal quality from all three states is similar, then delivered cost is the key to steam coal sales to Virginia electric utilities. Coal from eastern Kentucky and West Virginia was provided at a lower delivered cost than coal from Virginia. Coal from eastern Kentucky had the lowest FOB mine price, and coal from West Virginia was moved at the lowest transportation costs. Since coal from Virginia had a weighted-average FOB mine cost lower than that from West Virginia, its present disadvantage is in its higher transportation costs. All of the mines involved in the study are served by a single railroad system, and all of the utility plants involved are served by a single railroad system. Lowest transportation costs resulted if the mine and the utility were served by the same rail system. An extra $2 to $3 a ton was required to move the coal 6 to 7 miles to the utility on a second system. The Virginia coal industry's future is tied inescapably to NS, which transports its coal and determines the delivered costs. Future growth requires that NS meet CSX transportation competition costs in order that Virginia coal can compete with West Virginia and eastern Kentucky coal on the basis of delivered cost. Increased Virginia coal sales require the close cooperation of Virginia coal suppliers, transporters, and users. Negotiators directly representing Virginia's Governor might be able to help bring this about.

43707 **(PB—85-199651/XAB) Potential for US steam-coal imports.** (International Trade Administration, Washington, DC (USA)). Apr 1985. 82p. NTIS, PC A05/MF A01.

This report presents the findings of the first part of a two-part Congressionally-directed study on the potential for imports of steam coal into the United States with expanded marketing efforts by foreign suppliers. Part I is an analysis of the potential penetration of foreign coal into the U.S. utility market in 1990 and its impact on domestic coal production. Part II presents in-depth profiles of five foreign countries which have previously exported coal to the United States and have the potential to expand their marketing efforts. These countries are Australia, Canada, Colombia, Poland and South Africa.

0160 Health And Safety

REFER ALSO TO CITATION(S) 43621, 43639, 43642, 43661, 43674, 43678, 43679, 43683, 44909

43708 **(CONF-8506170—1) Importance of workshift in determining risk of fatal and lost work day injury accidents.** Watson, A.P. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016370.

From International conference on the health of miners; Pittsburgh, PA, USA (2 Jun 1985).

The importance of workshift as a mine accident risk factor has not been fully explored in any readily available analysis of national mine safety. This study begins to correct that deficiency by presenting frequency distributions of fatal and lost-time injury accidents segregated by workshift and elapsed time into the shift as experienced by US coal mine workers for the years 1978 to 1980. Variables of interest in the current analysis include time of accident, shift, mining method (i.e., surface vs underground), degree of injury (i.e., fatal vs lost-time), victim age, job title, nature of injury, machinery victim was operating or handling at the time of accident and source/nature of injury. 3 refs., 8 figs., 2 tabs.

43709 **(PB—85-198224/XAB) Comparison of rotary and in-hole motor techniques for drilling horizontal boreholes in coal. Report of Investigations/1985.** Kravits, S.J.; Sainato, A.; Finfinger, G.L. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 38p. (BM-RI—8933). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-23099.

This report describes and compares the procedures, capital investments, and operating costs of rotary and in-hole motor-drilling techniques used to drain methane gas from the Pittsburgh Coalbed in an underground mine located in southwestern Pennsylvania. A time study was conducted during the drilling of each of two boreholes, and the data were collated to serve as a base for comparing drilling procedures and operating costs.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 43682

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 43737, 44123

43710 **(NP—5752494) Project EASTMAR. Final report.** Thorning, L.; Larsen, H.C.; Jacobsen, N.L. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). May 1982. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752494.

In March 1978 the Energy Agency, Ministry of Commerce (now the Ministry of Energy), granted 8 million D.kr. to be used for an aeromagnetic study of major parts of the continental shelf of East Greenland. The project, proposed by the Geological Survey of Greenland (GGU), was accepted as a long-term energy research programme intended to provide geological and geophysical information so that the regional hydrocarbon potential of the area can be evaluated. The project, named EASTMAR (East Greenland Margin), was to be carried out under the auspices of GGU. Project EASTMAR was in 1979, expanded by a 3-year marine geophysical programme by grants from the European Economic Community. The new project thus formed was called NAD (North Atlantic D). The present report is the final report of project EASTMAR, and it informs on the planning and execution of the project, whereas the technical and scientific use of the aeromagnetic data will continue together with that of the other marine geophysical data. Accordingly only the objective results of project EASTMAR, appendix A, B, C and a general account of the status of the geophysical investigations is given in this report together with a preliminary map and description of the sedimentary basins of the shelf. The remaining sections give details of the management and economics of the project and a general evaluation of the project as such. The plans for the future treatment of the aeromagnetic data, and some recommendations for future work are discussed. Because the total activities to be carried out by GGU in the area now also include seismic work, the final conclusion and evaluation will not be included in this report. The interpretation of the total body of data is now fully integrated, and one season of seismic field work still remains. The final report on project NAD (late 83) will then contain the combined interpretation of both the aeromagnetic data and the seismic data.

43711 (SAND—84-0288, pp 41-44) **Borehole seismic experiments at sea.** Stephen, R.A. (Woods Hole Oceanographic Institution, Woods Hole, MA). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43712 (SAND—84-0288, pp 75-76) **Experimental basis for a new borehole corrected pulsed neutron capture logging system (TMD).** Schultz, W.E.; Smith, H.D. Jr.; Verbout, J.L.; Bridges, J.R.; Garcia, G.H. (Welex, A. Halliburton Co., Houston, TX). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43713 (SAND—84-0288, pp 77-78) **Analysis of dipmeter data for determining the direction of the minimum horizontal stress.** Plumb, R.A. (Schlumberger-Doll Research, Ridgefield, CT). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43714 (SAND—84-0288, pp 106-108) **Frontiers for petrophysics and borehole log analysis.** Livingston, D.E. (Dept. of Energy, Grand Junction, CO). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43715 (SAND—84-0288, pp 119-120) **Determination of thermal neutron cross sections for the calibration of porosity logs.** Lysne, P.C. (Sandia National Labs., Albuquerque, NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43716 **(UCRL—92395) Investigation of subsurface structure with borehole gravimetry.** Hearst, J.R. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 22p. (CONF-851054—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016436.

From Society of Mining Engineers fall meeting; Albuquerque, NM, USA (16 Oct 1985).

Conventional logging tools such as density, neutron, and acoustic have ranges of investigation of tens of centimeters. The borehole gravimeter, however, has a range up to hundreds of meters. For example, from the center of a cylindrical orebody 0.22 g/cm^3 denser than its surroundings, one can detect the boundary of the orebody at a radius as large as five times its height. More complex structures can be investigated with computer programs. We can predict the usefulness of proposed gravity surveys, or decide which suggested structure is most likely to have caused the results of existing surveys. 45 refs., 7 figs.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 43746, 44116

43717 **(DOE/BC/10069—29) Mechanism of oil bank formation, coalescence in porous media and emulsion stability. Final report.** Wasan, D.T. (Illinois Inst. of Tech., Chicago (USA)). Oct 1985. Contract AC19-79BC10069. 182p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85000142.

The underlying objective of this program is to develop an understanding of the simultaneous flow of oil and water in enhanced oil recovery operations. The emphasis is towards high pH flooding processes. The investigations presented in this report are a continuation of the investigators previous experimental and modeling studies pertaining to both displacement and mobilization mechanisms in porous media, and alkali-acidic crude oil interactions. Much of this work was undertaken to develop an integrated approach to model/simulate enhanced recovery processes using alkaline agents. In this report the development and the results of the investigations are presented in two areas: (1) fluid-fluid interactions in acidic oil/caustic systems; and (2) mobilization and displacement mechanisms. The first section is relevant to high pH flooding processes. The second is applicable in general to mechanisms of multiphase fluid flow in porous media. The main objectives of the work in these areas was to develop a broad understanding in the specifics of phase equilibria and fluid flow in random media. It is anticipated that these fundamental ideas along with other relevant topics such as rock-fluid interactions can be brought together to develop a reasonable chemical model that would predict oil recovery, saturation and concentration profiles for the process of interest. The fluid-fluid interactions study includes the development of a dynamic model based on their previous interfacial activity model and its application to the prediction of interfacial tension between an isolated oil globule and the injected high pH solution. Experimental studies have also been conducted to verify the hypotheses of their equilibrium model. 94 refs., 44 figs., 12 tabs.

43718 **(DOE/BC/10321—20) Improved polymers for enhanced oil recovery: synthesis and rheology. Final report.** McCormick, C.L.; Hester, R.D. (University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science). Oct 1985. Contract AS19-80BC10321. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85000141.

Research during FY-84 was centered on synthesis, characterization, and rheological behavior of copolymers of acrylamide (AM) with sodium-3-acrylamido-3-methyl-butanoate (NaAMB). Reactivity ratios were determined and copolymers with designated microstructures were synthesized in order to assess solution properties. Polymers were characterized by C-13 NMR and Infrared Spectroscopy, low angle laser light scattering, quasielastic light scattering, viscometry, turbidimetry, and potentiometric titration. New light scattering and size exclusion chromatographic (SEC) techniques have been developed for more accurately measuring molecular size of high molecular weight, water-soluble copolymers. The improved sensitivity of SEC methods is attributable to the development of a new syringe pump, a sensitive pressure detector, and deconvolution techniques in conjuction with the utilization of efficient column packing materials. The AM/NaAMB copolymers show immense potential for use as mobility control agents in enhanced oil recovery due to their remarkable calcium tolerance and unusually high molecular weights as compared to conventional acrylamide-sodium acrylate copolymers of similar microstructure. 133 refs., 34 figs., 26 tabs.

43719 **(RISO-M—2487) Horizontal fracture well testing model.** Klint Jensen, P. (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752491.

A computer program has been constructed to calculate dimensionless pressure as a function of dimensionless time for a model of a producing horizontal fracture. The model may also be used to simulate short-time pressure behaviour for a vertical fracture in a hydraulically fractured well. A mathematical model by Gringarten and Ramey has been used. Serious printing errors appearing in their paper have been corrected here.

43720 (SAND—84-0288, pp 39-40) **Downhole measurement experiments and experiences in the deep sea drilling project.** Anderson, R.N.; Zoback, M.D. (Columbia Univ., Palisades, NY). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43721 (SAND—84-0288, pp 51-52) **Fracture zone identification using vertical seismic profiling methods.** Henyey, T.L.; Leary, P.C. (Univ. of Southern California, Los Angeles). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43722 (SAND—84-0288, pp 67-71) **Coring technology: where are we and what lies ahead?.** Radford, S.R.; Carroll, J.L. (Christensen Drilling Products, Salt Lake City, UT). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43723 **In-Situ Stress Measurements at U.S. DOE's Multiwell Experiment Site, Mesaverde Group, Rifle, Colorado.** Warpinski, N.R.; Branagan, P.; Wilmer, R. (Sandia National Laboratories). *Journal of Petroleum Technology;* **37**: No. 3, 527-536(Mar 1985).

Vertical distribution measurements of the minimum principal in-situ stress in the lower Mesaverde group (7,300to 8,100-ft (2225- to 2470-m) depth) at the U.S. DOE's Multiwell Experiment (MWX) site have been made by conducting small-volume, hydraulic-fracture stress tests through perforations. Accurate, reproducible results were obtained by conducting repeated injections in each zone of interest with a specially designed pump system, modified high-resolution electronic equipment, and a downhole shut-off tool with a bottomhole pressure (BHP) transducer. Stress tests were conducted in marine sandstones and shales as well as in coal, mudstone, and sandstone in a paludal depositional environment; these tests provide a detailed stress distribution in this region. The stress magnitudes were found to depend on lithology. Marine shales above and below the blanket sands have large horizontal stresses that are nearly lithostatic, with a fracture gradient greater than 1.0 psi/ft (23 kPa/m). This indicates that these rocks do not behave elastically and processes such as creep and possibly fracturing are the dominant mechanisms controlling the stress state. Sandstones and siltstones have much lower stresses, with a fracture gradient of 0.85 to 0.9 psi/ft (19 to 20 kPa/m). Containment of hydraulic fractures would be expected under these conditions. Only three data points were obtained from the paludal interval; no significant stress differences were observed in the different lithologies.

43724 **Development and Status of the Maljamar CO_2 Pilot.** Pittaway, K.R.; Deckert, L.B.; Hoover, J.W. *Journal of Petroleum Technology;* **37**: No. 3, 537-544(Mar 1985).

This paper describes the planning, testing, and decisionmaking steps that were taken in the development of the tertiary CO_2 flood pilot in the Permian age carbonate rock formations of the Maljamar Cooperative Agreement (MCA) Unit. Injection and production history through 1983, a discussion of operating techniques and problems, and a summary of the logging results at the observation wells are given.

0205 Products And By-products

REFER ALSO TO CITATION(S) 44659, 45039

0206 Health And Safety

REFER ALSO TO CITATION(S) 43747

43725 (EPRI-NP—3912-SR-Vol.2, pp 95.1-95.9) **Human operator failures in petrochemical facilities. An historical investigation and a tentative simulation model.** Bello, G.C. (ENI, Italy). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920542. (CONF-850206—Vol.2).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

This paper concentrates on methodologies for the study of human errors in petrochemical plant operation. An investigation has been made on the causes of incidents that have occurred over the past 30 years in refining and petrochemical facilities, and accidents initiated by human error are identified. An analysis has been made using the TESCO model to evaluate human failure probability as related to: (1) the type of activity being performed; (2) the time available to perform; (3) the human operator's characteristics, (4) the operator's emotional state; and (5) the environmental ergonomics characteristics.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 43744, 44459, 44477, 44480, 44486, 44489, 44491, 44494, 44495, 44506

43726 (CRS—85-81E) Proposed superfund tax increases and the US petrochemical industry: an economic analysis. Lazzari, S.; Gelb, B.A. (Library of Congress, Washington, DC (USA). Congressional Research Service). 19 Apr 1985. 35p. Congressional Research Service, Washington, DC. File Number TI85902103.

This report analyzes the expected economic impact of hypothesized large increases in Superfund taxes on the US petrochemical industry. In general, it finds that the hypothesized tax increases would raise average production costs of six major primary petrochemicals by 3 to 5%, and that the resulting decline in industry profitability in the long-run would lead to a reduction in output and employment and to an increase in prices. 4 tabs.

43727 (DOE/EIA—0109(85/06)) Petroleum Supply Monthly, June 1985. (USDOE Energy Information Administration, Washington, DC). Aug 1985. 104p. NTIS, PC A06/MF A01 - GPO; GPO Dep. File Number DE85017288.

US supply, disposition and stocks of crude oil and petroleum products are reported for each year from 1973 through 1985, with monthly data given for the most recent 3 years. Detailed statistics are given for the most recent month available. Shown are: supply and disposition for the US and each Petroleum Administration for Defense (PAD) District; production of crude oil and lease condensate by State and PAD District; natural gas processing plant production by PAD District; refinery operations by PAD District; imports and exports of crude oil and petroleum products; stocks of crude oil and products by PAD District; transportation between PAD Districts; and heavy fuel oils by sulfur content. A glossary, maps of various Districts, and explanatory notes discussing the data collection methodology are included. This issue features an article on "timeliness and Accuracy of Petroleum Supply Data". This article examines the various factors that affect the quality of weekly and monthly petroleum data statistics. 13 figs., 34 tabs.

43728 (DOE/EIA—0380(85/06)) Petroleum Marketing Monthly. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jun 1985. 155p. NTIS, PC A08/MF A01 - GPO; GPO Dep. File Number DE85017501.

The report presents monthly summaries of crude oil and refined petroleum marketing statistics for the US, Petroleum Administration for Defense (PAD) Districts, and individual states. Four types of petroleum product statistics are included: sale prices, sale volumes, percentages of product sales, and first sales of products for consumption. Salient statistics are highlighted in a summary section, and each of the above subjects is treated in detail in other sections. The first tables in each of the sections provide national-level statistics on sales of the various products to end-users and for resale. The remaining tables provide finer geographic and type of seller details and are grouped by product, beginning with motor gasoline and ending eith either residual fuel oil or propane. The majority of the tables show data for the reporting month and previous month of the current year. Data on motor gasoline, aviation fuel, jet engine fuel, kerosene, distillate fuel oils, residual fuel oils, and propane are included. A glossary of terms is attached. 14 refs., 75 tabs.

43729 (DOE/PE/70267—T15) Inventories, arbitrage, and public-private interactions . Montgomery, W.D.; Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Nov 1982. Contract AC01-80PE70267. 59p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016767.

Energy and National Security Series: Discussion Paper D-82L.

This paper provides a theoretical analysis of optimal Strategic Petroleum Reserve (SPR) size which explicitly addresses the effect of government storage on private incentives to hold oil inventories. Using a noncooperative game model of stockpiling decisions (in which private parties take into account the impact on oil prices of government stockpile fill and release, and vice versa) the paper develops an analytical framework for assessing how moderation of price upswings reduces private storage incentives. This outcome is shown to follow whether the government takes a "leadership" role in stockpiling as the "dominant player", while keeping its own intentions confidential, or makes a public commitment to a course of action. The lesson for policy making is that SPR plans which treat private stocks as fixed and thus ignore private responses to public actions are inefficient. Both government agencies and private parties have a role to play in promoting national security through stockpiling, and the public interest is best served when these roles are harmonized. The authors also show how sole reliance on the SPR can never be better than "second best" energy policy. While stockpiling can be used to smooth out price fluctuations, it does not exploit the potential transfer of wealth from exporters through monopolistic buying practices. Nor does it lead to cost minimizing capital stock adjustments in the face of uncertain oil prices. Thus there are unresolved questions in the theoretical analysis, particularly when private consumption decisions do not reflect the long run social cost of imports and thus are inefficient from society's point of view. One such question is whether stockpiles should be managed differently when they are the only instrument of energy policy than when they are used in conjunction with other measures. 15 refs., 6 figs.

43730 (DOE/PE/70267—T16) Inventories and quantity constrained equilibria in regulated markets: the US Petroleum Industry, 1947-1972. Eckstein, Z.; Eichenbaum, M.S. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016768.

Reliable knowledge of how domestic energy supplies respond to changing prices is needed to assess the impact of an oil disruption and to estimate the value of ameliorative policies such as import tariffs and the Strategic Petroleum Reserves. Over the longer run, supply response has a bearing on how rapidly alternatives to imports will be developed. Further, price responsiveness is a central consideration in debates over the wisdom of price controls. Historical data on prices and supplies must be used in deriving empirical estimates of this response. Unfortunately, these data represent observations taken under strikingly different regimes, especially with regard to import restrictions and market demand prorationing in the case of oil. Are these data, distorted as they are, useful in projecting the response of domestic producers to future import disruptions or government policy shifts. This report addresses these issues by applying the theory of rational expectations to develop a model of the oil industry under prorationing restrictions. The model is computationally tractable, and the supply functions derived from it can be contrasted to supply relationships in the absence of regulation. The contrast is sharp: the two relationships predict systematically different responses to price. Based on these differences, the authors argue that much of the observed low responsiveness to price during the period of prorationing can be attributed to the controls and may convey a seriously misleading picture of how suppliers will react to price changes now that the controls no longer act to stabilize prices. While the model is based on a highly stylized description of the structure and operation of the petroleum industry, the methodology developed in the paper points a way toward more accurate estimation of how producers will respond to changing prices and regulatory environments.

43731 (DOE/PE/70267—T25) Linear-quadratic games of resource depletion . Epple, D.; Hansen, L.P.; Roberds, W. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 58p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016772.

Energy and National Security Series: Discussion Paper D-82Q.

In this paper we describe some methods for quantitatively analyzing dynamic, multiple agent models in which at least one agent takes into account his influence on the aggregate environment such as the degree of competitiveness in the petroleum industry. We confine our attention to models in which the agents solve stochastic, quadratic optimization problems subject to linear constraints. Discussion is presented in the context of a resource depletion example. The players are resource suppliers; the task is to compare their behavior when they play alternative dynamic games. Our approach to solving these models of dynamic games is first to deduce the stochastic Euler equations for each of the agents and then to simultaneously solve these stochastic Euler equations subject to the respective transversality conditions. The solution strategy involves factoring the characteristic polynomial of the system of stochastic difference equations. 22 refs.

43732 (DOE/PE/70267—T29) Two illustrations of the importance of dynamics for modeling energy-capital substitutability. Bain, I.R.M.; Whiteman, C.H. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 63p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016770.

Energy and National Security Series: Discussion paper D-82O.

Effects of high and uncertain oil prices upon the growth and stability of the economy are addressed. A key component is the effects of energy price increases on the level of capital investment. Energy price shock propagation through the economy also depends on how capital utilization is affected, and on whether changes in capital utilization dampen or amplify a shock arising in world oil markets. The straightforward way of ascertaining those effects is by estimating the elasticity of substitution between capital and energy, defined as the percentage change in the ratio of capital to energy inputs caused by a 1% increase in the price of energy relative to that of capital. Researchers have come to dramatically opposed conclusions in regard to the sign of the elasticity of substitution leading to uncertainty about prospects for the economy in the presence of changing energy prices and to confusion as to what policy measures might be appropriate. This report shows how errors in the specification of econometric models might be responsible for the contradictory results obtained by researchers. The authors then question whether correctly estimated elasticities of substitution can in principle provide unambiguous answers to questions about how energy price shocks affect the economy. Theoretical and numerical examples show that conventional substitution elasticities convey little useful information because knowing the sign of the elasticity of substitution is not sufficient to determine whether an oil price shock will alter demand for capital at any particular point in time. Even the accepted premise that energy and capital are complements in the short run and substitutes in the long run is shown to be of little help in predicting the dynamic response to an energy price shock. These results lead the authors to propose an alternative, explicitly dynamic approach to analyzing energy-capital substitutability.

43733 (DOE/PE/70267—T30) Social cost of imported oil and US import policy . Bohi, D.R.; Montgomery, W.D. (Resources for the Future, Inc., Washington, DC (USA)). Dec 1981. Contract AC01-80PE70267;AC02-76CH00016. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016756.

Energy and National Security Series: discussion paper D-82A.

The question addressed is with US oil prices at world levels, does the world price accurately measure the true cost of imported oil to the US economy. If there are costs to imports not factored into private energy use and production decisions - an "import premium" - then total welfare could be enhanced by government policies that lessened the rate at which we use foreign oil. Import reduction, based at least implicitly on the existence of such a premium, has been the proximate target for energy policy for much of the same period that, paradoxically, saw price controls providing incentives in exactly the opposite direction. "Men of affairs" seem to have gravitated toward two contradictory views of the premium paid when we import rather than conserve or produce additional barrels of oil. On the one hand, there is implicitly the view that the premium is zero. Market forces are believed to provide the proper signals to the private sector, and thus will yield the correct import level. Any imposed change in the level of imports would make the country worse off. The contrary view is that importing oil poses risks from disruptions, limits our diplomatic and military freedom of action and transfers wealth abroad. Hence fewer imports are better than more, a view consistent with a positive premium. Conflicting policies are advocated on the basis of these views. This report evaluates the premium concept and estimating its size. Findings from an investigation of the role of disruption risks in changing the social cost of imported oil are reported. The import premium notion is subjected to careful evaluation from the perspective of economic theory. Results indicate that the issue is more complex than either of the polar views noted above suggest. Decision rules are suggested that provide useful guidance to decision makers, though they cannot substitute for the application of informed judgement. 19 refs., 1 fig., 1 tab.

43734 (DOE/PE/70267—T46) OPEC's investments and the international financial system. Mattione, R.P. (Brookings Institution, Washington, DC (USA)). 1985. Contract AC01-80PE70267. 211p. The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036. File Number TI85016741.

Few events of the past decade have affected the global economic and political landscape as much as the sharp increase in the price of oil in 1973-74 and again in 1979-80. The massive transfer of real resources from mostly Western oil-consuming nations to oil-producing countries, especially to members of the Organization of Petroleum Exporting Countries, raised widespread fears that actions of OPEC nations could disrupt world financial markets, that oil markets and energy supplies would become unstable, and that a significant shift of political power would increase international tensions. In this study of how OPEC nations have used and learned to invest their wealth, Richard P. Mattione shows that the fears, have not in any significant way been realized. Mattione is the first to analyze in detail the size and distribution of the investments, their effects on the international financial system, and the motivations behind each OPEC member's investment strategy. Analyzing hard-to-find data from a variety of sources, he argues that investments in the United States and elsewhere have been motivated at least as much by conventional financial considerations - the need for liquidity, diversification, safety, and adequate rate of return - as by oil policy, development policy, or political considerations. He also traces the growth of these countries' abilities to absorb funds through internal development, their growing sophistication in financial planning and in moving Arab banks into international financial markets, and their mixed success in using aid to Third World countries to further their foreign policy goals. The book concludes with an analysis of the interplay of oil prices and policy, development needs, and financial strategies and their implication for the investments of each OPEC member in the 1980s. 33 tabs.

43735 (PB—85-195535/XAB) Cooperative petroleum operations. Cooperative information report. Eversull, E.; Dunn, J.R.; Mather, J.W. (Agricultural Cooperative Service, Washington, DC (USA)). Apr 1985. 36p. NTIS, PC A03/MF A01.

Cooperatives play a vital role in providing petroleum products to U.S. farms. They provide services at all related levels of oil production, including exploration, crude oil, and natural gas production, refining and processing, wholesale and retail distribution, and related operations. Farmers in the United States spend about $1 of every $13 on production supplies and equipment for petroleum products. In 1982, they bought about 3.5 billion gallons of liquid fuel for production. For lubricating oil, grease, and liquified fuel, farmers spend about $7.7 billion.

0208 Waste Management

43736 (DOE/ID/12422—T1) Membrane separation processes in the petrochemical industry. Phase I, September 29, 1982-March 31, 1984. Li, N.N. (Signal UOP, Inc., Des Plaines, IL (USA). Research Center). 15 Dec 1984. Contract AC07-82ID12422. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017030.

This report describes research work focused on the development of new membrane processes which show significant savings in energy when compared with existing separation technology. Two applications have been selected for study. The first is liquid hydrocarbon separations where ultrafiltration membranes are used to separate low-molecular-weight solvents from high-molecular-weight oils. The second application involves CO_2/CH_4 separation for natural gas treating, enhanced oil recovery, and landfill gas. For both applications, a review of the literature is presented along with new data on membrane permeation and expected energy savings associated with the use of membrane technology.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 45105, 45106

43737 (PB—85-201119/XAB) Oil-spill risk analysis for the Gulf of Mexico (proposed sales 94, 98, and 102) Outer Continental Shelf lease area. Final report. LaBelle, R.P.; Nakassis, A.; Lucas, A.D. (Minerals Management Service, Reston, VA (USA)). Apr 1984. 175p. NTIS, PC A08/MF A01.

This report summarizes results of an oil-spill risk analysis conducted for the proposed Gulf of Mexico OCS Lease Sales 94, 98, and 102. The object of the study was to determine relative risks associated with oil-and-gas production in different regions of the proposed lease area. The study was done for consideration in the Environmental Impact Statement prepared for the lease area by the Minerals Management Service, and to aid in the final selection of tracts to be offered for sale. For the most likely find volume scenario, the proposed lease offering will result in an estimated 0.15 billion barrels of oil being found and produced over a period spanning 18 years. There is a 75% chance that no spills of 1,000 barrels or larger will occur and contact land. Over the 18-year period used for the most likely find scenario, the mean number of spills estimated to occur from the proposal is less than 5% of that estimated from importing crude oil by tanker.

43738 Light activation of genotoxic components in natural and synthetic crude oils. Strniste, G.F. (Los Alamos National Laboratory, Los Alamos, NM). pp 475-490 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (Oct 1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

The correlation between increasing mortality from malignant melanoma and decreasing latitude gives credence to the hypothesis that solar ultraviolet (UV) radiation is a principal cause of skin cancer in man. However, a recent examination of data concerning the incidence of malignant melanoma in areas of the United States for which there were adequate UV radiation records showed that no statistically significant relationship existed between the amount of UV radiation received and the frequency of melanoma mortality. It is reasonable to believe that other factors (e.g., environmental chemical pollutants) contribute in an additive or synergistic manner with UV radiation in the induction of skin melanoma. The role of various chemicals as sensitizers to UV light has been well documented. Photochemotherapy of various skin ailments is based on the skin-photosensitizing activities of treatment chemicals such as furocoumarins. However, it has also been shown for certain classes of environmental pollutants (e.g., polycyclic aromatic hydrocarbons) that light can photochemically transform them into direct-acting genotoxic agents. Several recent studies have examined the role of light in the photochemical transformation of a variety of complex mixtures derived from various energy technologies. The results of these studies strongly suggest that environmental and health risk assessment pertaining to many of these industrial effluents must include factors concerning their photochemicalactivating and transforming potentials.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 43726

43739 (DOE/PE/70267—T37) Iraq: Eastern flank of the Arab world. Helms, C.M. (Brookings Institution, Washington, DC (USA)). 1984. Contract AC01-80PE70267. 223p. The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036. File Number TI85016743.

Iraq, holding oil reserves second only to those of Saudi Arabia in the Middle East, is locked in a war with Iran whose outcome will affect Western energy supplies and the prospects for stability in the Arabian Gulf. Yet Iraq even now remains little known to Western governments and publics. This study is intended to enlarge understanding of Iraqi behavior and of the concerns that motivate its leaders. Rather than selecting issues of importance to other countries, the author focuses on the forces that influence policy formulation in Iraq and evokes the perspective from which the Iraqi government itself views its problems and sets its priorities. Part 1 examines the country's evolution into modern Iraq, explaining why problems that have recurred throughout Iraqi history have bedeviled all recent Iraqi governments and created tension between "Iraq the nation" and "Iraq the state." Part 2 discusses the Arab Ba'th Socialist party, which has dominated Iraqi political life since 1968. The author neither condemns nor praises this controversial party and its current leader, President Saddam Husain, but seeks to explain why they have adopted the positions and taken the actions that have characterized their rule. Part 3 analyzes the war between Iraq and Iran, its causes, and the decisions Iraq has made in light of its goals and its assumptions about Iran. The author finds that this is not simply "a war over borders" but a deeper conflict between Islamic conservatism and Arab nationalism. Looking beyond the war, the final chapter assesses Iraq's potential importance in the Middle East and to the world economy. 8 figs.

43740 (PB—85-192185/XAB) Energy policy project: petroleum and natural gas in Egypt. Final report. Choucri, N.; Shafei, M.Z. (Massachusetts Inst. of Tech., Cambridge (USA). Technology Adaptation Program). Jun 1983. 170p. NTIS, PC A08/MF A01.

Prepared in cooperation with Cairo Univ., Giza (Egypt).

Egypt's Energy Policy Project was designed to provide a comprehensive view of the roles of petroleum and natural gas in the Egyptian economy. The major elements and conclusions of research conducted under the project are summarized herein. Part I provides background information on the supply of and demand for petroleum and natural gas in Egypt and on recent changes in the structure of the Egyptian economy. In Part II, uses of energy in Egypt are detailed in terms of industrial uses and overall macroeconomic flows; policy issues are briefly addressed. Egyptian petroleum resources are examined in Part III, which presents the results of geological surveys of four petroliferous provinces as well as forecasts from a dynamic simulation model of the Egyptian petroleum industry; the model incorporates supply, demand, finance, and policy variables and can be disaggregated by region or actor (oil companies or the Government). In Part IV the best uses of natural gas in Egypt and the prices that should be charged for these uses are identified, while Part V presents a macroeconomic analysis of the likely effects of a rise in domestic petroleum prices. Finally, specific analyses yet to be undertaken are outlined.

43741 Arms and oil: US military strategy and the Persian Gulf. McNaugher, T.L. Washington, DC; The Brookings Institution (1985). 238p. The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036. File Number TI85016744. Contract AC01-80PE70267.

In the oil-rich Persian Gulf, a region crucial to the world's security and economic health, the United States confronts major challenges to its military and diplomatic skills. The Iranian revolution, the Soviet invasion of Afghanistan, and unpredictable turbulence have contributed to declining US influence in the area. In the

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United States, military questions about force size and strategy have sparked controversy over the proper US role in the Gulf. In this book Thomas L. McNaugher offers a military strategy for the Gulf that seeks to balance the risks of overinvolvement against the risks of neglect. The author, a research associate in the Brookings Foreign Policy Studies program, believes that the United States must cultivate the traditional security mechanisms of the states on the Arabian Peninsula, and he encourages cooperation with allies like Great Britain and France that historically have been involved in Gulf security. He argues that the United States should focus on protecting the Gulf states from external attack and on deterring further Soviet encroachment in the region, leaving internal security largely to the states themselves. 19 figs., 13 tabs.

0240 Storage

REFER ALSO TO CITATION(S) 43729, 44491, 44493

43742 **(DOE/FE—0037/6) Strategic Petroleum Reserve quarterly report.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve Program Office). 15 Aug 1985. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017385.

The quarterly report describes activities undertaken with respect to the development of the Reserve during the period April 1, 1985, through June 30, 1985. The introduction and summary briefly discuss program background and major activities of this quarter. Section II describes site development. Oil acquisition activities are reported in Section III. Other program topics are discussed in Section IV and information on the budget and cost of the Reserve is contained in Section V. The Strategic Petroleum Reserve underground storage facilities are being developed in three phases. Phase I, completed in 1980, consisted of the development of approximately 260 million barrels of storage capacity at five sites and construction of the St. James Marine Terminal. Phase II consists of storage capacity expansions at three Phase I sites by a total of 290 million barrels; cavern development is approximately 87% complete and oil fill is approximately 75% complete. Phase III development consists of the construction of a new 140-million barrel storage site at Big Hill, Texas, and the further expansion of three existing SPR storage sites by a total of 60 million barrels. The Administration has proposed a moratorium on further development and fill of the Strategic Petroleum Reserve at the end of fiscal year 1985. This proposal would result in deferring completion of Phase III until after the moratorium is lifted. Phase III development activities are in progress at all four Phase III storage sites. The total inventory of oil stored in the Strategic Petroleum Reserve reached 476,571,321 barrels during the quarter ending June 30, 1985. The average fill rate during the quarter was 162,548 barrels per day and the weighted average delivered price of crude oil during this quarter was $28.65 per barrel. 1 tab.

43743 **(FRNC-TH—2024) Lowering storage losses of volatile hydrocarbons by adsorption.** Pumarejos, R.D. (Institut National Polytechnique, 31 - Toulouse (France)). Nov 1983. 189p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752386.

Losses of hydrocarbons during storage in tanks are reviewed. This paper studies an adsorption column, containing silica gel, for elimination of losses in tanks with fixed walls. Adsorbed quantity is determined by chromatography. Two models are developed for adsorption front. An adsorption column and heat required are estimated for comparisons with other processes.

43744 **(GAO/RCED—85-115) Analysis of oil withdrawal and distribution tests for the Strategic Petroleum Reserve.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 8 May 1985. 30p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877. File Number TI85901760.

Report to the Chairman, Subcommittee on Environment, Energy, and Natural Resources, Committe on Government Operations, House of Representatives.

Periodic tests of the oil withdrawal and distribution capabilities of the Strategic Petroleum Reserve (SPR) would help demonstrate that the system will work in a crisis. GAO assessed the feasibility, cost, effectiveness, and oil market impact of several suggested SPR test scenarios involving either oil sales or storage and examined factors that should be considered in designing a cost-effective test. GAO noted that the suggested tests are generally feasible. However, to provide the most confidence in total SPR system reliability, a test should involve a drawdown and distribution at maximum sustainable capacities. Test costs could be minimized by storing a maximum of withdrawn oil at SPR terminal sites and by simulating oil sales. GAO also noted that a combined sales/storage test could be: (1) designed to stress the SPR system by maximizing both oil withdrawal and distribution and (2) sustained as long as desired but would likely cost more than either a sales or storage test. 1 fig., 4 tabs.

43745 (SAND—84-0288, pp 115) **High resolution temperature logging probe.** Fleming, R.P.; Owen, T.E.; Tranbarger, O. (Sandia National Lab., Albuquerque). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—). Contract AC04-76DP00789.

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

0250 Combustion

REFER ALSO TO CITATION(S) 43696

43746 **(CONF-8211146—1) Development of a low NO/sub x/ burner for enhanced oil recovery.** England, G.; Heap, M.; Kwan, Y.; Payne, R.; Pershing, D. (Energy and Environmental Research Corp., Irvine, CA (USA)). 1982. Contract AI01-80EV10473. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016810.

From Symposium on stationary combustion NO/sub x/ control; Dallas, TX, USA (1 Nov 1982).

Data derived at laboratory and pilot-scale has been used to develop a low NO/sub x/ burner which is capable of operating with high nitrogen liquid fuels such as crude oils and synthetic fuels. Emissions of NO/sub x/ can be minimized by application of a staged combustion process in which the first stage is thermally isolated and provides long residence time under high temperature, optimally fuel-rich conditions. The design criteria for this process were developed in a previous study which was carried out in a 70,000 Btu/h refractory tunnel furnace, and from these criteria two pilot-scale prototype burners have been developed and tested at 2 x 10^6 Btu/h and 12 x 10^6 Btu/h. The paper describes the results of the development tests and compares results of all three scales of experiment. Firing a heavy fuel oil containing 0.6% bound nitrogen, test results indicate that NO/sub x/ emissions of below 85 ppM (at 3% O_2) are possible while carbon monoxide and smoke are within acceptable limits. Translation of the design requirements to practical burner designs, and additional requirements for initial fuel/air contacting and second stage air addition are presented and discussed. Data obtained over a scale range of 30:1 show that residence time and temperature in the first stage are the single most important scaling parameters for this low NO/sub x/ burner design and aerodynamic effects are second order. A current EPA program to translate the bench-scale and pilot-scale experience into a 60 x 10^6 Btu/h burner design which can be retrofitted to existing thermally-enhanced oil recovery (TEOR) steam generators is discussed. 10 refs., 11 figs.

43747 **(FRNC-TH—1565) Contribution to the study of heavy hydrocarbon fires.** Lapeyronnie, J.M.M. (Paris-6 Univ., 75 (France)). 1981. 87p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751011.

Combustion of hydrocarbons in free air studied, in stationary state combustion velocity of heavy hydrocarbons is near 2 mm/min and combustion efficiency near 0.60 to 0.70. Conservation equations are established by introductin of turbulence intensity and drive coefficient for rising combustion gases. Equations are intergrated by the Runge-Kutta method and influence of wind and fire radius examined. Emissivity of turbulent flames with a high percentage of soot, is estimated around 0.63. Tests, called Proserpine operation are realized for comparing theoretical and experimental results.

Form and stability of plumes are evaluated, fire hazards are forecasted and radiated flux is estimated.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 44518, 44550

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 43710, 43714, 43716, 43758

43748 (SAND—84-0288, pp 62-64) **Downhole fluid sampler for geopressured gas wells.** Weres, O.; Hansen, L. (Lawrence Berkeley Lab., CA). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

0303 Drilling, Production, And Processing

43749 **(BG-Trans—07133) Process for the removal of CO_2 and possibly H_2S from natural gases.** Wagner, E.; Volkamer, K.; Wagner, U. (British Gas Corp., London; BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)). 1985. Translation of German Patent Application 83,109,427.1, May 2, 1984. 11p. NTIS, PC A02. File Number DE85902068.

The present invention relates to a process for the removal of CO_2 and possibly H_2S from natural gases containing CO_2 and possibly H_2S by means of an aqueous absorption liquid containing an alkanolamine. The natural gases containing CO_2 and possibly H_2S are treated in an absorption stage at temperatures from 40 to 100°C with an aqueous absorption liquid containing 20 to 70% by weight methyl diethanolamine. The natural gases treated are withdrawn at the head of the absorption stage, the absorption liquid charged with CO_2 and possible H_2S is withdrawn at the sump of the absorption stage and the charged absorption liquid is then regenerated in one or more pressure release stages and the regenerated absorption liquid is returned to the absorption stage. 1 fig.

43750 **(BGC/MRS/M—14950) Procedure for the hydrodesulphurisation of a gas containing oxygen and organic sulphur compounds.** (British Gas Corp., London). [1985]. Translation of French Patent Application 8,209,210, November 30, 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902060.

The procedure consists of treating the gas with hydrogen while passing it over a palladium catalyst, followed by a nickel-molybdenum or cobalt-molybdenum catalyst.

0304 Products And By-products

REFER ALSO TO CITATION(S) 44281

43751 (EGG/10282—1057, pp 12.1-12.13) **Thermal infrared analysis of flame front propagation in an LNG burn.** Brewster, S.B. Jr.; Doak, E.L.; Shines, J.E. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A series of experiments was conducted by Lawrence Livermore National Laboratory at the China Lake Naval Weapons Center to model the potential hazards of a liquified natural gas (LNG) spill. In these tests, a volume of liquified fuel was spilled onto a small man-made pond. Observations were made of the subsequent gaseous plume via an array of instrument towers located downwind. In several experiments, the plume was ignited. A helicopter-mounted thermal infrared imaging system provided continuous observation of the LNG burn over a 30 second interval. Analysis of this imagery provided a temporal history of the LNG flame front propagation.

0305 Marketing And Economics

REFER ALSO TO CITATION(S) 44506

43752 **(PB—85-219640/XAB) Gas Appliance Technology Center. Annual report, December 1983-November 1984.** Suchomel, F.H. (American Gas Association Labs., Cleveland, OH). Dec 1984. 164p. NTIS, PC A08/MF A01.

This report reviews the activity during the second year of Gas Research Institute's Gas Appliance Technology Center contract. It highlights work done on the review of specific gas appliance technologies including space-heating equipment, cooking equipment, water heaters, and integrated appliances. Efforts on the assessment of gas-utilization-related technologies is also summarized, including indoor air quality, gas-burner modeling, and heat-exchanger corrosion. Laboratory studies are reported including new equipment technology assessments, methods development, corrosion materials testing, and emission monitoring. The status of technology transfer and data-base formation are also noted. New technology applications include a low-NOx range oven, an integrated furnace/clothes dryer, and a porous matrix burner.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 45080, 45081

43753 **(DOE/EV/04447—T1) Detection of atmospheric methane using a two-wave length HeNe laser system.** Russ, R.M. Jr. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Jun 1978. Contract AC02-77EV04447. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85013218.

The Department of Energy has funded MIT to perform research on a reliable, short time response (30 Hz), and accurate (+-10%) field detection system to measure concentrations of atmospheric methane from .1% to 100%. This thesis describes the overall measurement system which has been investigated and the liquid natural gas (LNG) spill tests in which this instrument would be used. Special attention is given to: the optical absorption characteristics of methane, other natural gas species, and atmospheric water droplets (fog); the theoretical and practical considerations of a two-wavelength HeNe laser system; the design and testing of an intracavity Fabry-Perot etalon used to select the two individual laser wavelengths: the optical detection system; and the total optical system design. The feasibility of alternating between the two infrared laser lines (nu_1 = 2947.90 cm^{-1} and nu_2 = 2948.79 cm^{-1}) was demonstrated. Molecular absorption experiments verified the relative insensitivity of the two laser lines to other natural gas species and to fog. A rutile (TiO_2) etalon was extensively modeled and tested, and it provided the basis for the design of a germanium (Ge) etalon. Finally, detector temperature sensitivity and drift problems were solved by using a totally ac-coupled system. Methane concentration and temperature data will be processed by an on-board microprocessor over the span of one hour and stored on a magnetic cassette tape. A prototype device is being built and will be tested in an LNG simulation spill at the US Naval Weapons Center in California. 38 refs.

43754 **(DOE/EV/04447—T2) Data collection strategies for distributed data acquisition systems.** Dezmelyk, R.S. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Feb 1979. Contract AC02-77EV04447. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85013217.

Thesis.

The need to collect large quantities of data from spatially separated instruments, such as in studies of turbulent mixing phenomena in vapor clouds resulting from simulated spills of LNG, has led to an examination of the strategies and techniques available for collecting data from spatially separate instruments. This study concentrates on the effects of using microcomputer based "intelligent" instruments on the design of data collection systems used in large scale environmental experiments. Conventional telemetry systems require extensive field testing and careful design to ensure success-

ful operation with a large number of different high data rate instruments. Collecting and processing the data at each instrument can dramatically improve the performance of a telemetry system, but the problems of system design and testing remain. A central telemetry system is not needed if the data is stored locally at each instrument or cluster of instruments. The advantages of stand-alone instruments which store their own data include enhanced system reliability, greater flexibility of experiment design, and lower design and development cost. Many techniques are available for local data storage. CMOS RAM is preferred for capacities below 10k bytes of data; for larger quantities digital cassette tape drives are optimal. The selection of a suitable microcomputer for a given instrument requires a careful analysis of the software tasks and timing constraints required by the instrument. This potentially difficult design problem is mitigated by the designers control over the degree of coupling desired between the instrument and the microcomputer and the corresponding design complexity. 32 refs., 2 figs., 3 tabs.

43755 **(FERC—5017068) AVL-1 Pipeline Project. Environmental assessment: Tennessee Gas Pipeline Company (Docket No. CP84-441-002).** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation). Jul 1985. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85017068.

This environmental assessment (EA), prepared by the Federal Energy Regulatory Commission (FERC) staff, evaluates the environmental impact of the AVL-1 facilities proposed by Tennessee Gas Pipeline Company (Tennessee) in Docket No. CP84-441-002. Tennessee proposes to provide firm gas transportation service for customers in the Northeast. The proposed facilities include 75.4 miles of 8- through 30-inch-diameter pipeline loop, one new 7000-horsepower compressor station, 10,300 horsepower of additional compression, one new meter station, and appurtenances. Alternatives are also evaluated. After completing this EA, the FERC staff determined that construction and operation of those AVL-1 facilities previously analyzed would cause no significant change in the environmental impact identified in the "Tennessee/Boundary Looping Project: Final Environmental Impact Statement" (Tennessee/Boundary FEIS) issued February 1983. The staff also concluded that the new facilities not previously analyzed would not result in significant impact to the environment. This EA will be used in the regulatory decisionmaking process at the Commission and may be presented as evidentiary matter in formal hearings.

43756 **(FERC—85017069) DCQ Pipeline Project. Environmental assessment: Texas Eastern Transmission Corporation, Algonquin Gas Transmission Company (Docket Nos. CP84-429-001 and CP84-654-001).** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation). Jul 1985. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85017069.

The following topics are covered in this environmental assessment: (1) proposed action (facilities required for DCQ pipeline project; construction, operation, and maintenance; safety controls; abandonment); (2) environmental analysis of the DCQ pipeline project (geology and soils; water resources; vegetation, wildlife, and fisheries; land use, recreation, aesthetics, and socioeconomics; air quality; noise quality); (3) alternatives; and (4) conclusions and recommendations. 42 refs., 1 fig., 15 tabs. (AT)

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 43709

43757 (DOE/METC—85-7, pp 110-133) **Improvements in stimulation technology.** Raible, C.J. Nov 1984. NTIS, PC A23/MF A01. File Number DE85001961. (CONF-8411101—). Contract FC03-83FE60149.

From 3. annual western gas sands sub-program review; Morgantown, WV, USA (7 Nov 1984).

The objective of this project is to identify and evaluate factors contributing to formation and fracture damage by hydraulic fracturing. These studies will provide information to minimize reservoir rock and propped fracture damage. A description of work performed, a summary and recommendations are given.

43758 (DOE/METC—85-7, pp 304-314) **Development and maintenance of data bases.** Nov 1984. NTIS, PC A23/MF A01. File Number DE85001961. (CONF-8411101—).

From 3. annual western gas sands sub-program review; Morgantown, WV, USA (7 Nov 1984).

The purpose of this project was to develop and maintain data bases at the CER Corporation. There are currently five data bases. One is the Multi-Well Experiment (MWX) log/core data. The second is the MWX Reservoir Test Data. The third is the Wells of Opportunity Core/Log Data. The third is the tight sand stimulation and production data. The fourth is the WGSS Library. A brief description of each is given.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 43740

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 43755, 43756

43759 (USGS-OFR—83-846, pp 196-202) **Emergency gas-pipeline policy.** Means, M. (Arkansas Louisiana Gas Co., Little Rock). 1983. Geological Survey, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI85900612. (CONF-8309330—).

From Workshop on continuing actions to reduce potential losses from future earthquakes in Arkansas and nearby states; North Little Rock, AR, USA (20 Sep 1983).

Arkansas Louisiana Gas Company should be prepared in advance to implement an organized emergency plan to minimize hazards to the public and to protect public and company property in the event of a gas pipeline emergency. Procedures include receiving and classifying information, communications, emergency response, coordination of activities, preparedness planning, returning facilities to service, public relations and media contact.

0330 Properties

REFER ALSO TO CITATION(S) 45080

43760 **(PB—85-200350/XAB) Analyses of natural gases, January 1, 1917-December 31, 1984. Data file.** Armstrong, G.R.; Moore, B.; Hamak, J. (Bureau of Mines, Amarillo, TX (USA). Helium Field Operations). 1984. vp. Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

This tape contains routine analyses and related source data for 13745 natural gas samples. These samples were collected as a part of a continuous survey of the free world for occurrences of helium. This survey has been conducted in the United States by the Bureau of Mines since 1917. In late 1965, the study was expanded to include foreign gasfields. Samples released for publication have been published in a series of USBM bulletins and information circulars. This tape contains all samples released for publication through December 31, 1984. (It replaces previous tapes). There is one record on the tape for each sample analysis. The tape does not contain a label, standard or non-standard. The tape is a nine-track, 1600 BPI, odd parity, ASCII tape. Each record contains 328 characters. The records are blocked 1 (one) per block. Helium Field Operations of the Bureau of Mines, located in Amarillo, Texas, may be contacted for further information.

43761 **(BG-Trans—07117) Determination of limits of flammability of gases and gas mixtures in air.** (British Gas Corp., London; DIN Deutsches Inst. fuer Normung e.V., Berlin (Germany, F.R.)). [1985]. Translation of DIN 51 649-Part 1, Draft, April 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902067.

A standardized test procedure is presented for determining limits of flammability of gases and gas mixtures at atmospheric

pressure and temperatures within the range of ambient temperature to 200°C. 5 figs., 5 tabs.

0340 Combustion

REFER ALSO TO CITATION(S) 43752

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 43684

43762 **(SAND—85-1170) Oil Shale Program. Quarterly reports, April 1984-September 1984.** Hommert, P.J. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017211.

Highlights of the principal activities during the quarter ending September 1984 are summarized. The program addresses and integrates information on bed preparation and characterization and retorting processes. Separate abstracts have been prepared for each report for inclusion in the Energy Data Base. 24 refs., 30 figs., 6 tabs. (DMC)

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 43762

43763 **(DOE/FE/60177—T1) Report on 10-ton retort tracer testing: tests S76 through S79.** Turner, T.F. (Western Research Inst., Laramie, WY (USA)). Jul 1985. Contract FC21-83FE60177. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016579.

An oil shale retort with contrasting permeability regions has been studied using gas tracer techniques. The Western Research Institute's 10-ton retort was loaded with oil shale of various size ranges resulting in different void fractions. Four retorting and tracer runs were performed on the retort. For each run, tracer injections were made into the main air flow inlet and into taps near the top of the retort. Detection taps were located at four levels in the retort with five taps on each level in tests S76 through S78. There were six taps on each level in run S79. The oil shale rubble bed was configured with a cylindrical nonuniform region on the center line of the retort in tests S76 through S78. In run S79 two side-by-side regions with differing bed properties were tracer tested and retorted. Response times were calculated from the tracer response curves. The tracer response times from in-bed tracer tests correlate with oil yield and with bed properties. Response times from the inlet-to-outlet tracer tests correlate with total oil yield through a first-order relationship with sweep efficiencies. 8 refs., 6 figs., 1 tab.

43764 **(PNL-SA—13211) Partitioning and chemical speciation of volatile trace elements during inert gas oil shale retorting.** Olsen, K.B.; Evans, J.C.; Sklarew, D.S.; Girvin, D.C.; Nelson, C.L.; Lepel, E.A. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 16p. (CONF-850761—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016613.

From 1. annual tar sand/oil shale contractors' meeting; Morgantown, WV, USA (9 Jul 1985).

The purposes of this study are to determine partitioning of Hg, As, and Se among spent shale, shale oil, retort water, and offgas during the retorting process and to identify Hg, As, and Se species in shale oil, retort water, and offgas. These species were investigated in eastern and western shales retorted at slow (1 to 10°C/min) heating rates to final temperatures of 500 and 750°C. The evolution of Hg in the offgas during retort run PNL-2 occurred in two clearly defined stages, with elemental Hg appearing first followed by the organomercury. During the initial stage of Hg release into the offgas, 87% (4 μg) was identified as elemental. The organomercury appeared at the later stage of Hg evolution in the retort run, accounting for more than 99% (126 μg) of the mercury in that sample. In general, more than 90% of the As remained in the shale after retorting. The As in the western shale demonstrated a slightly greater tendency to mobilize into the liquid products than did the As in the eastern shale retorted under similar conditions. The As that mobilized preferentially redistributed into the shale oil rather than the retort water in both eastern and western shales, and the redistribution into the liquid products appeared to increase with higher heating rates and maximum temperatures. No As was observed in the offgas during any of the three retort runs monitored. In general, more than 80% of the Se remained in the shale after retorting. The selenium in the eastern liquid products slightly favors partitioning into the retort water. Selenium in the western liquid products is preferentially redistributed into the shale oil. 15 refs., 10 figs., 2 tabs.

0405 Properties And Composition

43765 **High-pressure pyrolysis of Green River oil shale.** Burnham, A.K.; Singleton, M.F. (Lawrence Livermore National Lab., CA). *ACS Symposium Series;* No. 230, 335-351(1983). Contract W-7405-ENG-48.

From 185. meeting of the American Chemical Society; Seattle, WA, USA (20-25 Mar 1983).

Oil yields, compositions and rates of evolution are reported for heating rates from 1 to 100°C/h and pressures of 1.5 and 27 atm. Pyrolysis occurred in an autogenous atmosphere and volatile products were allowed to escape the pyrolysis region continuously. Higher pressures and lower heating rates during pyrolysis cause a decrease in oil yield, although the effects are not additive. The lowest oil yield was approximately 72 wt% or 79 vol% of Fischer assay. Lower oil yield is generally accompanied by lower boiling point distribution, nitrogen content and density and higher H/C ratios. Oils produced at high pressure and slow heating rates are a clear amber color instead of the usual opaque brown. The effect of pyrolysis conditions on biological markers and other diagnostic hydrocarbons is also discussed. Existing kinetic expressions for oil evolution slightly overestimate the shift in the oil evolution rate vs. temperature with a decrease in heating rate. Finally, the rate of oil evolution is retarded by pressure, a factor not taken into account by current kinetic expressions.

0406 Direct Uses And By-products

43766 **(EPRI-AP—3348-Vol.3) Guidebook for the use of synfuels in electric utility combustion systems. Volume 3. Liquid fuels derived from shale and tar sands. Final report.** Shiomoto, G.H.; Muzio, L.J.; Yang, R.J. (KVB, Inc., Irvine, CA (USA)). Aug 1985. 155p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920815.

A guidebook has been structured to assist utilities in addressing the technical issues associated with conversion of boilers, gas turbines, and diesel engines from conventional petroleum fuels, or natural gas, to tar sands and shale oil-derived fuels. To the extent possible, the information contained in this guidebook is drawn from direct utility or industrial experience with these fuels. This includes two demonstrations in utility boilers, two demonstrations in utility gas turbines and three demonstrations in utility sized diesel engines. The majority of those tests have been conducted with tar sands-derived fuels. The topics covered in the guidebook include the storage and handling, fuel supply and combustion systems, performance and operational impacts on the combustion system, emissions, and health and safety considerations. 101 refs., 20 figs., 9 tabs.

0407 Health And Safety

REFER ALSO TO CITATION(S) 43767

0410 Environmental Aspects

REFER ALSO TO CITATION(S) 45105, 45106

43767 Toxicology of large-scale refining of shale oil. Stallard, C.W.; Krautter, G.R. (The Standard Oil Co., Cleveland, OH). pp 137-148 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (Oct 1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Interest in the development of oil shale deposits in the United States has waxed and waned for several decades even though small-scale operations have taken place for about 100 years. A recent sharp upsurge in activity was followed by a dramatic decline in interest. The future remains uncertain, but the resource is still available. Although the economic aspects of oil shale extraction will undoubtedly determine whether oil is to be produced from shale, the recent activity has established a level of technology that indicates production is feasible and that products derived from extraction are both similar and different from natural petroleum crudes, synthetic crudes, and products derived from other fossil sources. Questions concerning the similarities and differences have instigated research in several disciplines to determine what the nature of the products might be, what toxicological hazard is inherent in the defined materials, and how that hazard is translated into human and environmental risks.

05 NUCLEAR FUELS

0501 Reserves

REFER ALSO TO CITATION(S) 43799, 43802, 43804, 43805, 45930

43768 (IAEA-TECDOC—322, pp 9-14) **Definition and classification of surficial uranium deposits.** Toens, P.D.; Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Uraniferous surficial deposits may be broadly defined as uraniferous sediments or soils, usually of Tertiary to Recent age, that have not been subjected to deep burial and may or may not have been cemented to some degree. Evaluation of the available literature shows that confusion has arisen as to the use of the term "calcrete" when describing fluviatile sediments that have been calcified to a greater or lesser degree. It is felt that a useful purpose would be served by proposing a classification system which may go some way towards a redefinition of the applicable terminology. Unfortunately the terms "calcrete" or "valley calcrete" have been used to define Tertiary to Recent sediments ranging from boulder beds to silts which, in some Namibian examples, contain between 5 and 50% $CaCO_3$ and as much as 90% total carbonate in some Australian surficial uranium deposits. It is proposed that the detrital material constituting the sediments be prefixed with the terms calcareous, dolomitic, gypsiferous, halitiferous or ferruginous (e.g. calcareous grit) rather than the terms calcrete, dolocrete, gypcrete, and ferricrete, all of which have genetic connotations. The latter group of terms are preferably used for the pedogenic uranium deposits only. This will have the effect of placing these deposits in categories of their own and not confusing the issue with the overprint of pedogenic calcrete or duricrustal deposits which may or may not be present. This view is not shared by some authorities notably Butt and Carlisle (see this volume).

43769 (IAEA-TECDOC—322, pp 15-24) **Non-pedological hypothesis for the processes of uranium mineralization in calcrete.** Briot, P.; Fuchs, Y. (Paris-6 Univ., 75 (France)). Dec 1984. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The non-pedological hypothesis presented for the origin of the uraniferous calcrete deposits in Western Australia is based on the premise that alluvial and calcareous lacustrine sediments were initially formed during earlier wet periods, evidence for which has been found in the fossil records. These were followed by subsequent epigenetic alteration accompanied by the precipitation of uranium mineralization during drier semi-arid periods. Typical examples of the processes involved were found in the Yeelirrie uranium deposit. During the latter semi-arid period, the limited surface flow which consisted of periodic flash flood conditions probably contributed marginally to the recharge of the groundwater, and consequently, semi-stagnant groundwater conditions evolved, particularly where the hydraulic gradient was extremely small, for example, for the Yeelirrie channel it is approximately 0.001. In addition, ponding of water behind a natural barrier caused the groundwater to evolve along the following geochemical sequence: mild alkalinity, weak oxidizing conditions, and oversaturation in dissolved elements. These hydrological and hydrogeochemical conditions induced the epigenetic alteration of the palustral/lacustrine limestone, bringing about dolomite neogenesis and the precipitation of carnotite. The source of the uranium in the calcretes and the groundwater of the Yeelirrie channel is considered to be the weathered outcrops of the breakaways along its margins. The genetic hypothesis proposed in this paper, although somewhat different from those described previously and elsewhere in this volume, could be applied to the other uranium-bearing calcretes in Mauritania, Namibia, and Somalia.

43770 (IAEA-TECDOC—322, pp 25-35) **Surficial uranium occurrences in relation to climate and physical setting.** Carlisle, D. (California Univ., Los Angeles (USA). Dept. of Earth and Space Sciences). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Important surficial chemogenic uranium deposits develop within 1) calcretes, 2) simple evaporative environments and 3) bogs or similar organic environments ("young" uranium). Calcrete occurrences are the largest, most novel and most dependent upon extreme aridity and geomorphic stability. Economic calcrete deposits are nonpedogenic, resulting from near-surface groundwater transport and lateral concentration of uranium, vanadium, potassium, calcium, and magnesium rather than from ordinary soil-forming processes. Their genesis is essentially observable in Western Australia where carnotite-bearing nonpedogenic calcrete is currently forming under a unique aridic soil moisture regime and where major deposits have formed under similar climates during the last few thousand years. Rainfall is less than 250mm annually, only 1/12 to 1/20 of potential evaporation and concentrated almost entirely in episodic late summer storms. Outside this region, under less arid conditions, only pedogenic calcretes form and they do not contain economic uranium. In southern Africa, calcrete and gypcrete uranium deposits, although Late Tertiary to Quaternary in age, are also nonpedogenic and appear to have formed under similar climatic constraints with local variations in geomorphology and calcrete morphology.

43771 (IAEA-TECDOC—322, pp 37-44) **Petrology, mineralogy and geochemistry of surficial uranium deposits.** Pagel, M. (Centre de Recherches sur la Geologie de l'Uranium, Vandoeuvre-les-Nancy (France)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

A comprehensive understanding of the petrology, mineralogy, and geochemistry of surficial uranium ore deposits is important for developing prospecting and evaluation strategies. Carnotite is the main uranium mineral and is found in those deposits that have the greatest potential uranium resources. The following uranium-

bearing minerals have been reported to occur in surficial deposits: carnotite, tyuyamunite, soddyite, weeksite, haiweeite, uranophane, betauranophane, metaankoleite, torbernite, autunite, phosphuranylite, schroeckingerite, Pb-V-U hydroxide (unnamed mineral), uraninite and organourano complexes. The interrelationships between some of the minerals of the host rocks (especially the clays) are not well understood.

43772 (IAEA-TECDOC—322, pp 45-52) **Genesis of surficial uranium deposits.** Boyle, D.R. (Geological Survey of Canada, Ottawa, Ontario). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium deposits can form in such diverse environments as calcareous-dolomitic-gypsiferous fluvial and aeolian valley sediments in hot arid and semi-arid regions, oxidizing and reducing alkaline and saline playas, highly organic and/or clay-rich wetland areas, calcareous regoliths in arid terranes, laterites, lake sediments, and highly fractured zones in igneous and metamorphic basement complexes. Formation of ore is governed by the interrelationships between source of ore-forming elements, mechanisms of migration, environment of deposition, climate, preservation, tectonic history and structural framework. The principal factors controlling mobilization of ore-forming elements from source to site of deposition are the availability of elements in source rocks, presence of complexing agents, climate, nature of source rock regolith and structure of source rock terrane. The major processes governing precipitation of uranium in the surficial environment are reduction mechanisms, sorption processes, dissociation of uranyl complexes, change in redox states of ore-forming constituents, evaporation of surface and groundwaters, change in partial pressure of dissolved carbon dioxide, changes in pH, colloidal precipitation, and mixing of two or more surface and groundwaters. One or a number of these processes may be actively involved in ore formation.

43773 (IAEA-TECDOC—322, pp 53-59) **Uranium in lateritic terranes.** Samama, J.C. (Ecole Nationale Superieure de Geologie Appliquee et de Prospection Miniere, 54 - Nancy (France). Centre de Recherches Radiogeologiques). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The occurrence of uranium anomalies in iron-rich surficial formations (gossans and lateritic soils) is reviewed and most are classified according to their origin; the behaviour of uranium in lateritic landscapes is complex but two main physico-chemical processes control the geochemical behaviour of uranium. These are 1) co-precipitation of iron and uranium, and 2) physical adsorption on active iron-rich surfaces. Both processes are pH dependent. During the weathering of pyritic rocks, soluble uranium and iron sulphates are formed; their co-precipitation by neutralization results in high-grade uranium anomalies. Uranium is adsorbed by mainly amorphous iron hydroxides and, to a lesser extend, goethite, both of which have large adsorption surface areas. The pH of the surficial environment plays an important role in determining the distribution and density of the surface electrical charges that, in turn, control the adsorption efficiency of the iron hydroxide surfaces. The identification of the type of uranium anomalies and an understanding of the processes of concentration and dispersion can assist the interpretation and selection of field geochemical anomalies.

43774 (IAEA-TECDOC—322, pp 119) **Surficial uranium deposits in Australia.** Butt, C.R.M.; Mann, A.W. (Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Mineralogy). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

Published in summary form only.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

43775 (IAEA-TECDOC—322, pp 121-127) **Regional setting, distribution and genesis of surficial uranium deposits in calcretes and associated sediments in Western Australia.** Butt, C.R.M.; Mann, A.W.; Horwitz, R.C. (Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Mineralogy). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium deposits in Western Australia are largely in the Yilgarn Block in areas of Archean granitoids and greenstones, and in the Gascoyne Province in Proterozoic granites and gneisses. The region has had a long weathering history marked by continuous planation developing a regolith up to 100 metres thick. The distribution of calcrete type uranium deposits is controlled by geologic as well as weathering, erosion and climatic factors. Valley, playa and terrace deposits are recognized. The principal known surficial uranium deposit, Yeelirrie, occurs in the Yilgarn block as a valley deposit.

43776 (IAEA-TECDOC—322, pp 129-132) **Lake Austin uranium deposit, Western Australia.** Heath, A.G. (Broken Hill (Pty.) Ltd., Perth (Australia)); Deutscher, R.L. (Commonwealth Scientific and Industrial Research Organization, Port Melbourne (Australia). Div. of Mineral Chemistry); Butt, C.R.M. (Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Mineralogy). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Lake Austin uranium deposit is a calcrete type deposit in the Yilgarn Block, near Cue, in a catchment area of granitoids and greenstones. The uranium is in valley fill and the sediments of the Lake Austin playa. The mineralization occurs over 1 to 6 meter thickness close to the water table in calcrete overlying clays and/or weathered bedrock. The principal uranium mineral is carnotite. Waters in nearby channels have an uranium content of over 30 ppb. The chloride content of the water increases downstream in the nearby drainages, as does the uranium and vanadium content.

43777 (IAEA-TECDOC—322, pp 133-136) **Hinkler Well - Centipede uranium deposits.** Crabb, D. (Carpentaria Exploration Co., Brisbane (Australia)); Dudley, R. (Esso Minerals Ltd., Nedlands (Australia)); Mann, A.W. (Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Mineralogy). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Hinkler Well - Centipede deposits are near the northeastern margin of the Archean Yilgarn Block on a drainage system entering Lake Way. Basement rocks are granitoids and greenstones. The rocks are deeply weathered and overlain by alluvism. Granitoids, the probable uranium source, currently contain up to 25 ppm uranium, in spite of the weathering. The host calcrete body is 33 km long and 2 km wide. Uranium up to 1000 ppm occurs in carnotite over a 15 km by 2.5 km area.

43778 (IAEA-TECDOC—322, pp 141-148) **Lake Raeside uranium deposit.** Gamble, D.S. (BP Australia Ltd., Melbourne). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Lake Raeside uranium deposit is in the Yilgarn block, 60 km from Leonora in an area of granites with 8 to 10 ppm uranium. Waters near the deposit are nearly saturated with carnotite. The area is a mature peneplain with deep weathering and slow ground water movement. The deposit has an estimated 1700 tonnes of U_3O_8 at an average grade of 0.025% U_3O_8. Carnotite is the only uranium mineral. The postulated mode of formation has the granite as the source rock and uranium movement as a carbonate. On concentration by evaporation the uranium was released and formed carnotite.

43779 (IAEA-TECDOC—322, pp 149-156) **Lake Way uranium deposit, Wiluna, Western Australia.** French, R.R.; Allen, J.H. (CSR Ltd., Adelaide (Australia)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Lake Way uranium deposit, 16 km southeast of Wiluna, is in an area of granites with around 12 ppm uranium, and greenstones, near the edge of the playa Lake Way which is the drainage base for a large ancient drainage system. The deposit is carnotite in calcrete and is below or near the water table in areas of high salinity. The deposit has over 5000 tonnes U_3O_8, averages 1,55 m thick and is at depth of 0-10 meters. The deposit was discovered by an airborne radiometric survey.

43780 (IAEA-TECDOC—322, pp 157-164) **Yeelirrie calcrete uranium deposit, Western Australia.** Cameron, E. (Western Mining Corp. Ltd., Belmont (Australia)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Yeelirrie deposit, between Wiluna and Sandstone, lies in the Yilgarn block, in a catchment area of deeply weathered granites and greenstones. The host calcretes are a 1 to 1.5 km wide valley-fill in a long established drainage system, and are developed over a 85 km long distance. The calcretes are either earthy or procellaneous with voids. The deposit is sheetlike, some 9 km long and 5 to 1.5 km wide, averaging 3 m thick and is 4 to 8 meters below the surface, and immediately below the water table. The deposit has 52,500 tonnes of U_3O_8 at an average grade of 0.15% U_3O_8. Carnotite is the only uranium mineral. Water movement in the area is largely subsurface in the calcrete, which is a good aquifer. Uranium concentrations of 100 to 450 ppb are found in the calcrete ground waters compared to background values of 5 to 10 ppb.

43781 (IAEA-TECDOC—322, pp 165-170) **Uranium series disequilibrium in the carnotite deposits of Western Australia.** Dickson, B.L. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Mineral Physics). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Studies have been made on the radioactive equilibrium conditions at four calcrete type uranium deposits in Western Australia: Yeelirrie, Centipede, Lake Way and Lake Maitland. The comparatively young apparent age of such deposits and their near surface oxidizing environment has raised concerns about their radioactive equilibrium and the applicability of radiation measurement techniques. However, only the Yeelirrie deposit exhibited a high radiation disequilibrium condition that could effect the usefulness of gamma measuring instruments. The deposit has some 9 per cent excess Radium 226 attributed to an excess of ^{234}U in the deposit. Yeelirrie appears to be the youngest of the four deposits but reliable age determinations are difficult. Uranium may have been flushed from the other deposits increasing their apparent age.

43782 (IAEA-TECDOC—322, pp 171-178) **Surficial uranium deposits in Botswana.** Mortimer, C. (Geological Survey Dept., Lobatse (Botswana)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The known surficial uranium deposits in Botswana are supergene concentrations either in soils above lower Karoo sediments, or in peat and calcified alluvium of dry stream courses in the Kalahari Desert. A number of uranium occurrences lie above Karoo sedimentary rocks and of these Mokobaesi No. 1 is the best explored. It is a tabular body of disseminated uranium ochre occurring immediately below surface in calcrete and calcified mudstone. The uranium is believed to have migrated upwards from the Karoo rocks. Reconnaissance investigations show that moderately anomalous uranium occurs at a number of localities in peat and calcified sediments that have been deposited in ephemeral water courses. None of these deposits are economic, but the known occurrences are encouraging indications that such deposits may exist in the thick Tertiary to Recent "Kalahari beds", that were deposited in diverse palaeoenvironments.

43783 (IAEA-TECDOC—322, pp 179-191) **Surficial uranium deposits in Canada.** Culbert, R.R. (D.G. Leighton and Associates, Vancouver (Canada)); Boyle, D.R. (Geological Survey of Canada, Ottawa, Ontario); Levinson, A.A. (Calgary Univ., Alberta (Canada)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial ("young") uranium deposits in Canada occur in such diverse regions as semi-arid, alpine and permafrost terrains. Two broad classes of deposits are recognized, namely lacustrine/playa and fluviatile types. Subclasses are based largely on specific environments of deposition. Deposits of this type are formed at or within a few metres of the surface by the interaction of ground or surface waters with various components of soils and sediments. These deposits contain few, if any, daughter products and the uranium is loosely bonded and hence easily remobilized. Molybdenum is a common companion to uranium and vanadium is characteristically absent. Virtually all deposits occur in areas underlain by intrusive rocks varying from intermediate to felsic in composition. Detection of these deposits is dependent upon the recognition of 1) potential source lithologies; 2) suitable climatic conditions for formation and 3) geomorphic features capable of trapping uranium.

43784 (IAEA-TECDOC—322, pp 193-196) **Surficial uranium deposits of northern Chile.** Perez Andraca, L.E. (Comision Chilena de Energia Nuclear, Santiago). Dec 1984. (In Spanish). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Uranium deposits have recently been discovered in Upper Cenozoic clastic sediments and salt deposits of the Tarapaca and Antofagasta regions of northern Chile. At the southeast edge of the Salar Grande, which is a saline playa within the coastal mountain range, carnotite is associated with clay and blue halite that form epigenetic cements in Pleistocene and Holocene fluvial and deltaic sands and gravels. The uranium anomalies are related to east-west fractures and shear zones in Cretaceous granodiorites. The granodiorites may be the source of the uranium; however, Tertiary ignimbrites and tuffs in the Cordillera of the Andes cannot be excluded. Other uranium occurrences are associated with chert and carbonaceous diatomaceous earth that occur in Pliocene and Pleistocene sedimentary rocks deposited in a semi-arid fluvial-lacustrine environment.

43785 (IAEA-TECDOC—322, pp 197-200) **Uranium enrichment in European peat bogs.** Wilson, M.R. (Sveriges Geologiska Undersoekning, Luleaa). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

In Europe peat bogs are extensively developed but high uranium concentrations have been reported from only a relatively few in Sweden, Finland and the United Kingdom. Because of the limited tonnage of uranium ore it is unlikely that they would ever become economically viable. The distribution of uraniferous peat bogs is governed by enrichments of labile uranium in the source rocks.

43786 (IAEA-TECDOC—322, pp 201-203) **Surficial uranium deposits in Mauritania.** Briot, P. (Paris-6 Univ., 75 (France)). Dec 1984. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

In the Ain Ben Tili region of northern Mauritania, uraniferous calcareous clastic sediments have been discovered at the base of the flat hammada surfaces overlooking the Saharan Reg. The groundwaters are phreatic, neutral to slightly alkaline, and have a high content of total dissolved solids, particularly sodium and chloride. The source of the uranium in the hammadas is the calc-alka-

line granite of the Reguibat basement which contains between 20 and 30 ppm uranium. Precipitation of the epigenetic uranium minerals and calcium carbonate is due to oscillations in the groundwater table and occurred behind local structural barriers.

43787 (IAEA-TECDOC—322, pp 205-216) **Surficial uranium deposits in Namibia.** Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Uranium resources of the surficial uranium deposits in the <$130/kg U cost category of Namibia amount to 33,300 t uranium, which constitute about 24% of the uranium inventory for that country. There are six relatively large, fluviatile surficial uranium deposits - Aussinanis, Tubas, Tumas, Langer Heinrich, Trekkopje and Spitskoppe - none of which are being mined at this time. In addition, there are a number of uneconomic pedogenic occurrences of which the biggest is Mile 72. The deposits occur in the central Namib Desert between the Great Escarpment in the east and the "western cutoff line" in the west, which is an area situated to the east of Walvis Bay. Uraniferous fluviatile sediments occur in the Namib Group, but mainly in the Langer Heinrich and Tumas Formations, which were deposited by high-energy, flash-flood conditions in deep palaeochannels formed during the Upper Cretaceous. The uranium occurs largely as carnotite in the Langer Heinrich Formation and is associated with calcite and dolomite, but in the Tubas deposit it is found in the gypsum-rich sediments of the Tumas Formation. The age of the uranium mineralization is probably Upper Tertiary. Precipitation of carnotite in the large fluviatile deposits was controlled mainly by redox reactions, the adsorption of vanadium on active surfaces and soil suction.

43788 (IAEA-TECDOC—322, pp 217-220) **Surficial uranium deposits in Somalia.** Briot, P. (Paris-6 Univ., 75 (France)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium deposits in Somalia are of the valley-fill calcrete type and occur in the arid Mudugh Province of the Dusa Mareb-El Bur region. They are located in a belt about 240 km in length which is orientated parallel to the north-south regional tectonic framework. The uranium resources of the region amount to about 5,000 t U_3O_8 at an average grade of 0.1% U_3O_8. Basement rocks constitute a 7,000 m thick succession of Jurassic to Quaternary sediments of the Somalian Basin. Uranium mineralization in the form of carnotite occurs in the uppermost Mercia Series. The origin of the uranium and vanadium is unclear due to a shortage of the favourable source rocks.

43789 (IAEA-TECDOC—322, pp 221-229) **Surficial uranium deposits in South Africa.** Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium deposits in South Africa contain 1000 metric tons U in the Reasonably Assured Resources $80-$130/kg U cost category, which constitutes only a minor proportion of the total uranium inventory. Currently, no deposits are being mined because of the depressed state of the world uranium market. Most deposits have been found on the Bushmanland Plateau, but there are a few below the escarpment and on the coastal plain. The fluviatile type, such as Brulkolk, and the lacustrine type, such as Abikwaskolk, Geelvloer, Dirkskop, Kannikwa and Henkries, are predominant. No significant uranium pedogenic occurrences have been found. Generally, the uranium mineralization occurs as carnotite in the oxidized sediments and is frequently associated with gypsum and calcite. In the reduced diatomaceous earth/peat environments such as Henkries and Kannikwa, uranium occurs probably as an urano-organic complex. The age of the uranium is Upper Tertiary to Recent.

43790 (IAEA-TECDOC—322, pp 231-235) **Surficial uranium occurrences in the United Republic of Tanzania.** Bianconi, F. (Uranerzbergbau G.m.b.H. und Co. K.G., Bonn (Germany, F.R.)); Borshoff, J. (Uranerz Australia (Pty.) Ltd., Perth). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium occurrences of undetermined economic potential occur in Central Tanzania, mostly within the Bahi interior drainage system. Low-grade, spotty uranium, occurring partly as discrete minerals (uranyl vanadates and silicates), is found in three types of deposit. The most common type consists of mineralized, near-surface, poorly developed pedogenic calcretes in Upper Tertiary to Recent sandy clays formed in the depressions (mbugas) of the present drainage systems. A second type occurs at the surface and consists of thin, mineralized, strongly silicified sheet calcretes developed directly over weathered granitic basement rocks. The third type is mineralized and silicified calcareous Upper Tertiary valley-fill sediments, locally called Kilimatinde Cement, lying either at depth in the mbugas or uplifted by rift faulting and exposed by present-day drainage that does not coincide with the palaeodrainage system.

43791 (IAEA-TECDOC—322, pp 237-242) **Surficial uranium deposits in the United States of America.** Otton, J.K. (Geological Survey, Denver, CO (USA)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Two important surficial uranium deposit types occur in the United States: 1) young uranium deposits associated with organic-rich, poorly drained, fluvial-lacustrine systems; and 2) carnotite deposits in calcrete horizons in the upper part of the Miocene and Pliocene Ogallala Formation in the southern High Plains of Texas. These two deposit types constitute a potentially large, but at present poorly understood uranium resource in the United States. The "young" uranium deposits are best known in northeastern Washington and northern Idaho, where they have formed in bogs, meadows, swamps, and lake bottoms along valleys in glaciated highland areas underlain by granitic massifs. The deposits are only slightly radioactive, as they generally have reached only 5 to 10% of radioactive equilibrium. Grades in this area reach 1% uranium and some deposits are as large as 500 metric tons. These deposits are amenable to small-scale mining methods. The carnotite deposits in calcrete in Texas resemble the deposits at Yeelirrie in Western Australia in that, 1) the deposits formed in calcrete that probably developed along a Pleistocene palaeodrainage; 2) carnotite occurs in vugs and fractures; 3) dolomitization and silification also occurred; and, 4) strontium is an important constituent of the deposits. Other types of surficial uranium deposits occurring in the United States and described here include the Lost Creek schroeckingerite deposits in Wyoming and karst cave tyuyamunite deposits in Wyoming and Montana.

43792 (IAEA-TECDOC—322, pp 243-247) **Surficial uranium deposits: summary and conclusions.** Otton, J.K. (Geological Survey, Denver, CO (USA)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Uranium occurs in a variety of surficial environments in calcretes, gypcretes, silcretes, dolocretes and in organic sediments. Groundwater moving on low gradients generates these formations and, under favourable circumstances, uranium deposits. A variety of geomorphic settings can be involved. Most surficial deposits are formed in desert, temperate wetland, tropical, or transitional environments. The largest deposits known are in sedimentary environments in arid lands. The deposits form largely by the interaction of ground or surface waters on the geomorphic surface in favourable geologic terrains and climates. The deposits are commonly in the condition of being formed or reconstituted, or being destroyed. Carnotite is common in desert deposits while in wetland deposits no uranium minerals may be seen. Radioactive disequilibrium is common, particularly in wetland deposits. Granites and related

rocks are major source rocks and most large deposits are in regions with enriched uranium contents, i.e. significantly greater than 5 ppm uranium. Uranium dissolution and transport is usually under oxidizing conditions. Transport in desert conditions is usually as a bicarbonate. A variety of fixation mechanisms operate to extract the uranium and form the deposits. Physical barriers to groundwater flow may initiate ore deposition. Mining costs are likely to be low because of the near surface occurrence, but there may be processing difficulties as clay may be present and the saline or carbonate content may be high.

43793 (IAEA-TECDOC—322) **Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.** (International Atomic Energy Agency, Vienna (Austria)). Dec 1984. 254p. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

Individual papers were abstracted and indexed separately for the data base.

43794 (IAEA-TECDOC—327) **Uranium biogeochemistry: A bibliography and report on the state of the art. Report prepared by the Biogeochemical Prospecting for Uranium Working Group, a subgroup of the Joint NEA/IAEA Group of Experts in R and D in uranium exploration techniques.** Dunn, C.E.; Ek, J.; Byman, J. (International Atomic Energy Agency, Vienna (Austria)). Feb 1985. 83p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85701953.

The report comprises a compilation of the world literature published up to the end of 1982, that is classified under the general heading of 'Uranium Biogeochemistry'. This subject examines the distribution of U within natural organic systems. To the exploration geologist the study is concerned mainly with the analysis of plant material in an attempt to identify variations in U concentrations which may be attributed to concealed U mineralization. In addition, references are included on geobotany. Information included in 130 papers is summarized in tabular form following the list of references.

0502 Exploration

REFER ALSO TO CITATION(S) 43771, 43774, 43775, 43776, 43782, 43783, 43793, 45930

43795 (IAEA-TECDOC—322, pp 61-64) **Exploration for surficial uranium deposits.** Hambleton-Jones, B.B.; Heard, R.G.; Toens, P.D. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The more important surficial uranium deposits usually occur in granitic terranes and in arid environments and these criteria are universally used in the application of satellite imagery for the detection of target areas for further prospecting. Evaluation of surficial deposits is particularly difficult due to the fact that the ore is usually out of equilibrium and erratically distributed in strata of varying degrees of consolidation. In order to cope with these variables special geochemical, geophysical and drilling techniques have been evolved. Some of the newer methods have shown that beta/gamma analysis and low-energy spectrometry hold considerable promise. Reverse circulation drilling with double walled rods and dry stick auger drilling with the analysis of the chips or cores being corroborated by gamma logging techniques have been found to give the best results in Australia.

43796 (IAEA-TECDOC—322, pp 65-69) **Application of supervised classification to Landsat data in the exploration for surficial uranium deposits - an example from Western Australia.** Krische, E.U. (Uranerzbergbau G.m.b.H. und Co. K.G., Bonn (Germany, F.R.)); Quiel, F. (Technical Univ. Karlsruhe, Inst. Photogrammetry (Germany, F.R.)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The digital evaluation of Landsat data (supervised classification) can give substantial support to the regional selection of targets for valley-fill deposits in arid areas. The approach is described with an example from Western Australia.

43797 (IAEA-TECDOC—322, pp 71-74) **Application of Landsat imagery for delineating potential surficial uranium deposits in Namibia.** Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria); Caithness, A. (National Institute of Telecommunications Research, Pretoria (South Africa)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

Published in summary form only.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

43798 (IAEA-TECDOC—322, pp 75-79) **Assessment of the use of hydrogeochemistry in exploration for calcrete uranium in Australia.** Middleton, W.G. Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The role of hydrogeochemistry in exploration for calcrete uranium deposits in Australia is reviewed and the sampling and analytical procedures used are described. The concept of carnotite solubility index (CSI) is introduced and a simplified derivation is given for field use. The various interpretation schemes are reviewed and compared. On the basis of experience in Australia, the uranium content of the aquifer was found to provide a guide to the fertility of the system, and anomalous vanadium concentrations in the groundwater could be related to carnotite mineralization. Using the simplified CSI function, values of -3 to zero and upwards were found to be indicative of prospective drainages. It is concluded that water sampling surveys carried out in conjunction with shallow drilling programs make for the most efficient use of hydrogeochemistry in calcrete exploration.

43799 (IAEA-TECDOC—322, pp 81-86) **Calculation of the carnotite solubility index.** Hambleton-Jones, B.B.; Smit, M.C.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The carnotite solubility index (CSI) has been found to be a useful prospecting technique for carnotite-rich uranium ore deposits. The approach adopted here for the calculation of the CSI utilizes actual concentrations of U,V,K, HCO-bar3 and pH determined in groundwaters which are used directly in a formula. A comparison is made of the CSI formulae proposed in this paper with those of Middleton and Gamble.

43800 (IAEA-TECDOC—322, pp 87-93) **Natural and induced disequilibrium in surficial uranium deposits.** Hambleton-Jones, B.B.; Andersen, N.J.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Natural disequilibrium within a surficial uranium deposit can vary widely, and care should be taken when comparing radiometric uranium concentration data from specific zones. For the deposit as a whole, the average disequilibrium tends approximately to unity. This implies that within a deposit, the uranium is constantly being dissolved and reprecipitated. Induced disequilibrium is brought about by the loss of ^{222}Rn during percussion drilling. This causes an apparent lowering of the uranium concentration due to a decrease in gamma-ray activity. This can be compensated for by applying a radon correction factor or allowing the sample to re-equilibrate after 13 d. The procedure of compensating for induced disequilibrium is suitable for those situations where chemical analytical facilities are not easily available and where on site radiometric monitoring of uranium grade is desirable.

43801 (IAEA-TECDOC—322, pp 95-100) **Geostatistical evaluation of the Napperby surficial uranium deposit, Northern Territory, Australia.** Akin, H.; Bianconi, F. (Uranerzbergbau G.m.b.H. und Co. K.G., Bonn (Germany, F.R.)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

A "highly erratic" distribution of the mineralization seems to be a characteristic common to all surficial uranium deposits. The distribution of the mineralization within the Napperby deposit, Northern Territory, Australia, has been investigated by means of geostatistical methods. The structural analysis, based on the calculation of semivariograms in several directions and on two different scales, revealed the presence of a large nugget effect and of small-scale and large-scale structures with anisotropies controlled by the drainage directions. The large nugget effect and the small-scale structure, the latter partly with a high amplitude, are the result of, and also quantify, the erratic distribution and the relatively high variability of the mineralization. Based on the obtained semivariograms, further geostatistical methods can be applied to optimize drilling patterns and spacings and to estimate reserves with minimal estimation errors.

43802 (IAEA-TECDOC—322, pp 107-111) **Surficial uranium deposits in Algeria.** Mokaddem, M. (Sonarem, Alger (Algeria)); Fuchs, Y. (Paris-6 Univ., 75 (France)). Dec 1984. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Along southern border of the Hoggar (Algeria) Precambrian shield, Lower Palaeozoic sediments lie unconformably on weathered metamorphic rocks. Along the eastern border of the Tin Seririne basin some good examples of the weathered rocks underneath the unconformity are exposed. The palaeosurface is a peneplain with only minor topographical reliefs from one to a few metres high. The nature and intensity of the weathering process was controlled by the topography, and the existence of badly drained areas is particularly important. At one such area the Tahaggart uranium ore deposit was discovered. The uranium ore consists mainly of torbernite and autunite. The deposit is present in the weathered gneiss underneath the palaeosurface. Mineralogical and geochemical observations indicated that the ore deposit was formed during the period of weathering which was controlled by climatological and palaeotopographical factors.

43803 (IAEA-TECDOC—322, pp 113-117) **Surficial uranium deposits in Argentina.** Rodrigo, F.; Olsen, H.; Belluco, A.E. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

In Argentina, several surficial Cenozoic uranium occurrences have been found. They are all of low grade, wide areal extent, occur near the surface, have varied thicknesses, are highly irregular in distribution, and have significant potential. Two deposits only have been fully evaluated, while the rest have only been found recently and remain unexplored. Three main types have been identified: 1. Uraniferous calcite- and gypsum-cemented clastic sediments of Cenozoic age. 2. Autunite and meta-autunite in intensely fractured granites. 3. Uraniferous calcareous sediments associated with hot springs in Quaternary volcanic fields.

43804 (IAEA-TECDOC—322, pp 137-140) **Lake Maitland uranium deposit.** Cavaney, R.J. (Carpentaria Exploration Co. (Pty.) Ltd., Perth (Australia)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

The Lake Maitland uranium deposit, 105 km southeast of Wiluna is in a playa in an Archean granitic terrain. The area is deeply weathered and of low relief. The deposit, in playa calcrete sediments is 6 km long by 0.3 to 0.5 km wide. Uranium Grades are generally below 700 ppm but some values exceed 1800 ppm. The uranium is in carnotite. Groundwaters in the playa contain 5 to 150 ppb uranium and 30 to 80 ppb vanadium.

0503 Mining

REFER ALSO TO CITATION(S) 45930

43805 (IAEA-TECDOC—322, pp 101-105) **Beneficiation of surficial uranium deposits.** Simonsen, H.A. (Council for Mineral Technology, Randburg (South Africa)); Floeter, W. (Uranerzbergbau G.m.b.H. und Co. K.G., Bonn (Germany, F.R.)). Dec 1984. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781532.

In Surficial uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.

Surficial uranium deposits are of interest to mining and utility companies because of the relative ease with which most of them can be mined. The recovery of uranium from surficial deposits poses some special problems that may tend to offset the cost advantages inherent in the potentially simple mining processes. The mineralogical characteristics of the surficial uranium deposits are used to provide constraints in the selection of beneficiation processes and the problems likely to be encountered in their application to the extraction of uranium.

0504 Feed Processing

REFER ALSO TO CITATION(S) 45930

43806 (FRNC-TH—1879) **Synthesis of new polyphosphonic acids, uranium extracting agents in a phosphoric medium.** Pensec, T. (Brest Univ., 29 (France)). Apr 1981. 96p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751189.

Synthesis of organic phosphorus compounds for liquid-liquid extraction of traces of uranium in concentrated phosphoric acid is studied in view of industrial applications. Diphosphonic acids and monoesters and also triphosphonic acids and related compounds are synthetized. Extraction tests show a better efficiency than OPPA. (103 refs.)

43807 (INIS-mf—9740, pp 184) **Uranium recovery from phosphoric acid with selective resins.** Belfer, S.; Korngold, E.; Egozy, Y. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

0505 Enrichment

REFER ALSO TO CITATION(S) 43902, 45930

43808 (CEA-CONF—7693) **Laser isotopic separation. Performance estimation.** Rigny, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 13p. (In French). (CONF-8409241—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752059.

From SFEN meeting on uranium enrichment; Paris, France (26 Sep 1984).

Characteristics of a laser isotope separation plant are obtained by a simple model. Energy consumption is evaluated at about 100 KWh/SWU and the capacity of a module at about 10^6 SWU/year in the case of the atomic process applied for uranium.

43809 (K—2055) **Uranium isotope fractionation resulting from UF_6 vapor distillation from containers.** Hedge, W.D.; Turner, C.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1 Jul 1985. Contract AC05-84OT21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016924.

This empirical study for possible isotopic fractionation due to UF_6 vapor distillation from valved containers was performed to

determine the effects of repeated vapor sampling. Four different experiments were performed, each of which varied by the method of measuring the isotopic contents and/or by the difference in temperature gradients as follows: The ratio of the parent UF_6 to the desublimed UF_6 collected at liquid nitrogen temperature and homogenized was measured by sampling the containers. The ratio of the parent UF_6 to the desublimed UF_6 collected at liquid nitrogen temperature and homogenized was measured by direct comparison to each other without subsampling. The ratio of the parent UF_6 to the desublimed UF_6 collected at liquid nitrogen and ice-water temperatures and homogenized was measured by indirect comparison to a common UF_6 reference material without subsampling. The ratio of the parent UF_6 to the desublimed UF_6 collected at liquid nitrogen temperature without homogenizing was measured by indirect comparison to a common UF_6 reference. Gas-phase, relative mass spectrometry was used for all isotopic measurements. Results of the study indicate that fractionation does occur. The U-235 isotope becomes more enriched in the parent container as the UF_6 is vaporized from it and desublimed into the receiving cylinder; i.e., the vaporized fraction is enriched in the U-238 isotope. The degree of fractionation indicates that the separation is due to the U-238 isotope of UF_6 having a higher vapor pressure than the U-235 isotope of UF_6. 3 refs., 4 figs., 4 tabs.

43810 (K/PS—1096) Uranium hexafluoride subsampling system. Hall, H.J.; Hedge, W.D.; Reid, D.D. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jul 1985. Contract AC05-84OT21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017249.

A uranium hexafluoride sampling system is currently being used at the Oak Ridge Gaseous Diffusion Plant (ORGDP) which (1) is low cost to fabricate, (2) is easy to maintain, (3) is convenient to operate, and (4) reduces risks associated with the use of high-heat sources (open flame torches). The new systems have been in use at the ORGDP for more than 15 months without substantial maintenance or operational problems. Use of the systems have not influenced analytical results and thus have the same quality of sample integrity as was inherent in the former systems. 2 refs., 5 figs.

43811 (UCRL—92706) Real-time fluid flow model for control of solidification. Kraftick, K.; Sholl, P. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 17p. (CONF-860107—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016286.

From 19. annual Hawaii international conference on system sciences; Honolulu, HI, USA (8 Jan 1986).

The Atomic Vapor Laser Isotope Separation (AVLIS) process is an advanced uranium enrichment technology being developed by the Lawrence Livermore National Laboratory. This process is designed to increase the concentration of ^{235}U in uranium from 0.7% as found in nature to approximately 3% as required for light water nuclear reactor fuel. Separation is accomplished by vaporizing uranium, selectively ionizing ^{235}U atoms and electromagnetically collecting these ions. The electromagnetic collector system utilizes resistance heaters to maintain a temperature range defined by the melting point of the metal product and tails collected and the materials compatibility limits between the liquid metal and the structure. If temperatures are not within these bounds, metal freezing or structural damage may occur which disrupts the process. Additionally, inappropriate heater usage could result in heater burn-out or overheating.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 44286, 45930

43812 (UCRL—53655) Initial stages of uranium oxidation: a surface study. Winer, K.A. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1985. Contract W-7405-ENG-48. 151p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85016653.

Thesis.

The initial oxidation reactions of clean, high-purity polycrystalline uranium metal surfaces with dry oxygen, pure water vapor, and dry carbon monoxide for temperatures between 85 and 298°K were studied with Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS), thermal desorption spectroscopy (TDS), and electron-induced luminescence (EIL). 100 refs., 43 figs., 3 tabs.

43813 Method of controlling crystallite size in nuclear-reactor fuels. Lloyd, M.H.; Collins, J.L.; Shell, S.E. (to Dept. of Energy). US Patent 4,502,987. 5 Mar 1985. Filed date 28 Sep 1982. vp.

PAT-APPL-426365.

Improved spherules for making enhanced forms of nuclear-reactor fuels are prepared by internal gelation procedures within a sol-gel operation and are accomplished by first boiling the concentrated HMTA-urea feed solution before engaging in the spherule-forming operation thereby effectively controlling crystallite size in the product spherules.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 43831, 43832, 43833, 43834, 43835, 43836, 43837, 43838, 43839, 43840, 43841, 43842, 43844, 43845, 43846, 43847, 43848, 43849, 43850, 43851, 43852, 43853, 44764, 44765, 45930

43814 (AECL—8067) Plutonium and U-233 mines. Milgram, M.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702033.

A comparison is made among second generation reactor systems fuelled primarily with fissile plutonium and/or U-233 in uranium or thorium. This material is obtained from irradiated fuel from first generation CANDU reactors fuelled by natural or enriched uranium and thorium. Except for plutonium-thorium reactors, second generation reactors demand similar amounts of reprocessing throughput, but the most efficient plutonium burning systems require a large prior allocation of uranium. Second generation reactors fuelled by U-233 make more efficient use of resources and lead to more flexible fuelling strategies, but require development of first generation once-through thorium cycles and early demonstration of the commercial viability of thorium fuel reprocessing. No early implementation of reprocessing technology is required for these cycles.

43815 (BMFT-FB-K—85-001) Dissolution of plutonium dioxide by sulfuric acid digestion of plutonium-containing waste and processes for separation of plutonium from sulfuric acid solutions. Stojanik, B.; Greiling, H.D.; Lieser, K.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie). Mar 1985. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751874.

With 10 refs., 21 tabs., 18 figs.

Plutonium dioxide in plutonium-contaminated waste is transformed by sulfuric acid digestion within 20 hours in amounts of 96 to 100% into plutonium sulfate, if it was heated before to temperatures up to 450°C. Plutonium dioxide heated to higher temperatures is only partially converted to plutonium sulfate. Plutonium in mixed oxides UO_2/PuO_2 is also transformed in amounts of 96 to 100% if it was heated before to 1700°C. For separation of plutonium from sulfuric acid solutions two processes were developed consisting of the following steps: a) Leaching of the plutonium sulfate containing residue by water or diluted sulfuric acid. b) Addition of nitrate to the sulfuric acid leach solution and extraction by HDEHP or HDEHP/TOTO in kerosene (by this process coextraction of sulfuric acid is avoided - in contrast to other processes). c) Back extraction of plutonium by oxalate (possible separation in form of the oxalate) or with carbonate, respectively. In a mixer settler, the processes were tested and investigated in detail. Sulfuric acid solutions from the Alona plant were also used.

43816 **(BMFT-FB-K—85-002) Dissolution of ThO_2, UO_2 and PuO_2 in nitric acid.** Greiling, H.D.; Lieser, K.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie). Mar 1985. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751875.

With 10 refs., 6 tabs., 7 figs.

Samples of ThO_2, UO_2 and PuO_2 are prepared by precipitation of the oxalates and of the hydroxides followed by heating at temperatures between 450 and 1400°C. Density, grain size distribution, specific surface area (by methylene blue adsorption and by the BET method), crystallinity (by Debye-Scherrer diagramms) and exchange capacity of the samples are determined. Dissolution in 7.5 M HNO_3 is measured as function of time. A relation is found between the rate of dissolution and the properties of the samples, in particular the exchange capacity. On the basis of this experimentally established relation equations for the rate of dissolution are derived with respect to the mechanism of dissolution of ThO_2, UO_2 and PuO_2.

43817 **(CEA-CONF—7683) Determination of hydrazoic acid in the solutions of the Purex process.** Wagner, J.F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1984. 1p. (In French). (CONF-8408162—1-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752060.

From 5. European conference on analytical chemistry; Cracow, Poland (26 Aug 1984).

Published in summary form only.

43818 **(CEA-R—5270) Lanthanides and trivalent actinides complexation by tripyridyl triazine, applications to liquid-liquid extraction.** Vitorge, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Aug 1984. 210p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751195.

The protonation constants of TPTZ (tripyridyl (2) - 2,4,6 triazine 1,3,5) have been measured: $pKa_1 = 3.8$ and $pKa_2 = 2.7$. (I = 1M, KCl). TPTZ can be autoassociated as (HTPTZ)sub(x)sup(x+) (x=3 or 4). The Am $TPTZ^{3+}$ formation constant (log $\beta = 4.22$) is more stable than the lanthanides ones: log β_1 = 2.23/3.16/2.81/3.35/3.11/3.00/2.50/2.43/2.43/2.03./2.00/2.09 and 2.3 respectively for La/Pr/Nd/Sm/Eu/Gd/Tb/Dy/Ho/Er/Tm/Yb and Lu. The selectivity of TPTZ is applied to investigate the groups separation actinides (III)-lanthanides by a liquid-liquid extraction procedure, from nitric acid into several diluents. Acidic extractants dibutylthiophosphoric, di-2 ethylhexyldithiophosphoric, α-bromocapric (H α B C_{10} or dinonylnaphtalensulfonic (HDNNS) acid were used to insure the organic complexes electroneutrality. Am(III) and Cm(III) and lanthanides are extracted into decanol as $M(\alpha\ Br\ C_{10})_3$ and MTPZ $(\alpha\ Br\ C_{10})_3$ this last complex is more stable with actinides (III) than with lanthanides (log Kew = -3,1 and -3,9 respectively). HDNNS-TPTZ mixtures form inverted micelles in t-butylbenzene and can extract the actinides 20 times better than the lanthanides from 0.3 M HNO_3. We explained qualitatively and quantitatively the extraction data, by assuming that HDNNS-TPTZ micelles behave like a 3rd phase.

43819 (CONF-840806—Vol.1, pp 4-10) **Advancements in reprocessing technology. Keynote address for the 18th DOE airborne waste management and air cleaning conference.** Bastin, C. (Dept. of Energy, Washington, DC). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Since 1978, the U.S. Government's power reactor fuel reprocessing R and D efforts have been combined under the Consolidated Fuel Reprocessing Program. This program is managed by the Oak Ridge Operations Office (ORO) and Oak Ridge National Laboratory (ORNL), with the bulk of the R and D being done by ORNL and its subcontractors. Primary emphasis of the program has been research and development directed toward reprocessing liquid metal fast breeder reactor uranium-plutonium fuels. A limited effort is focused on reprocessing thorium based fuels. Most of the development is generic and applicable to light water and other reactor fuels. Major advancements in new remote operating, sampling, and maintenance concepts and reprocessing equipment are discussed.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 44662, 45931

43820 **(DOE/RW—0026) Draft Transportaion Business Plan.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Aug 1985. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017061.

The Office of Civilian Radioactive Waste Management (OCRWM) is responsible for establishing a transportation system to support shipment of spent fuel and high-level radioactive waste to repositories and storage facilities developed under the Nuclear Waste Policy Act of 1982 (NWPA). An element that assists in fulfilling that responsibility is a business plan for acquiring and operating a transportation system. The Draft Transportation Business Plan is an interim step in the process of procuring the transportation system. It sets the context for business strategy decisions by providing pertinent background information, describing the legislation and policies governing transportation under the NWPA, and with establishing the transportation system. It also serves as an instrument for initiating communication between OCRWM and other interested parties. Included in the docuument are strategies for procuring shipping casks and transportation support services. Additionally, in the spirit of the NWPA directive to utilize the private sector to the maximum extent possible, opportunities for business ventures are obvious throughout the system development cycle.

43821 **(FRNC-TH—1876) Thermal study of a facility for dry storing bare irradiated PWR fuel elements.** Jimenez, J. (Paris-6 Univ., 75 (France)). Jan 1983. 92p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751156.

Storage of spent fuel is reviewed. Air cooling of a storage module for 300 fuel elements spread out on 3 levels is calculated. Operation by natural convection in the event of failure of the forced convection cooling system is examined.

43822 **(HEDL-SA—3301-FP) Use of commercial robotics in radioactive waste shipping and receiving.** Berger, J.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 15 Mar 1985. Contract AC06-76FF02170. 19p. (CONF-850425—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013745.

From Executive conference on remote operations and robotics in the nuclear industry; Pine Mountain, GA, USA (21 Apr 1985).

Radioactive waste shipping and receiving facilities presently planned for commercial and defense nuclear waste will handle waste packages at frequencies far in excess of those in common practice today. Unacceptable personnel exposure to ionizing radiation is projected to occur if current limits for radiation levels at the cask surface and current handling methods are used. To reduce these exposure levels, alternate handling methods are being developed and demonstrated. The production nature of cask receiving operations suggests commercial robotics be incorporated into a remote handling system to reduce predicted worker exposure to acceptable levels, while maintaining or increasing throughput. The first phase of cask handling system development culminated in a proof-of-principle test demonstrating the feasibility of performing cask receiving and unloading operations in a remote and partially automated manner. 6 refs., 12 figs.

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REFER ALSO TO CITATION(S) 43714, 43815, 43820, 43822, 43887, 43888, 43890, 43894, 43895, 44436, 44603, 44639, 44643, 44644, 44699, 44700, 44703, 44774, 45175, 45289, 45290, 45296, 45931

43823 (AECL—7787) Canadian nuclear fuel waste management program. Rummery, T.E.; Rosinger, E.L.J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). May 1983. 25p. (CONF-820933—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE85902166.

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

The Canadian Nuclear Fuel Waste Management Program is now well established. This report outlines the generic research and technological development underway in this program to assess the concept of immobilization and subsequent disposal of nuclear fuel waste deep in a stable plutonic rock in the Canadian Shield. The program participants, funding, schedule and associated external review processes are briefly outlined. The major scientific and engineering components of the program, namely, immobilization studies, geoscience research and environmental and safety assessment, are described in more detail.

43824 (AECL—7796) Effect on localized waste-container failure on radionuclide transport from an underground nuclear waste vault. Cheung, S.C.H.; Chan, T. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jul 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902165.

In the geological disposal of nuclear fuel waste, one option is to emplace the waste container in a borehole drilled into the floor of the underground vault. In the borehole, the waste container is surrounded by a compacted soil material known as the buffer. A finite-element simulation has been performed to study the effect of localized partial failure of the waste container on the steady-state radionuclide transport by diffusion from the container through the buffer to the surrounding rock and/or backfill. In this study, the radionuclide concentration at the buffer-backfill interface is assumed to be zero. Two cases are considered at the interface between the buffer and the rock. In case 1, a no-flux boundary condition is used to simulate intact rock. In case 2, a constant radionuclide concentration condition is used to simulate fractured rock with groundwater flow. The results show that the effect of localized partial failure of the waste container on the total flux is dependent on the boundary condition at the buffer-rock interface. For the intact rock condition, the total flux is mainly dependent on the location of the failure. The total flux increases as the location changes from the bottom to the top of the emplaced waste container. For a given localized failure of the waste container, the total flux remains unaffected by the area of failed surface below the top of the failure. For fractured rock, the total flux is directly proportional to the failed surface area of the waste container regardless of the failure location.

43825 (AECL—7976) Summary of methods for conditioning and immobilizing ion-exchange resins. Speranzini, R.A.; Buckley, L.P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1983. 42p. (CONF-830293—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702030.

From 3. IAEA research co-ordination meeting on the treatment of spent ion-exchange resins; Cairo, Egypt (28 Feb 1983).

Ion-exchange resins are used in CANDU-PHW nuclear power stations to purify heavy water in the primary heat transport (PHT) and moderator systems. Two promising techniques for conditioning spent ion-exchange resins for disposal have been evaluated: direct immobilization and incineration combined with immobilization of the ash and scrubbed off-gases. When ion-exchange resins were immobilized directly, volumes of bitumen products were about 0.75 times the volumes of untreated resin, while the volumes of cement and polyester products were 2 to 3 times larger. While incinerating the resin is an extra processing step, much smaller volumes result from the latter option. Bitumen and glass product volumes were six and ten times smaller, respectively, than the volumes of untreated resin, while cement and polyester product volumes were about one-half the volume of untreated resin. Since the releases of Cs-136 by leaching were lowest for products made by immobilization in glass, PHT resins which have high concentrations of Cs-137 should be vitrified. Moderator resins which have high concentrations of C-14 should be incinerated and the ash and C-14-contaminated scrubbing solutions should be immobilized. By pretreating such resins with calcium chloride or carbon dioxide, the C-14 present on resin could be released at temperatures below the ignition temperature of the resin. The pretreatment technique reduces the amount of inactive carbon dioxide that must be scrubbed to trap the C-14. The releases of C-14 from immobilized barium hydroxide scrubbing solution were the same as releases from immobilized resin.

43826 (AECL—8328) Assessing reliability and useful life of containers for disposal of irradiated fuel waste. Doubt, G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1984. 65p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702031.

Metal containers for fuel waste isolation are to be designed to last at least 500 years to provide a redundant barrier during the decay period of the high activity components of the waste. To meet the long-life requirement, containers must have a very low failure rate during the design mission, a low incidence of 'juvenile failures' due to undetected defects, and resistance to progressive deterioration from environmental processes. This paper summarizes studies to determine: (1) precedent for low failure rates and relevance to container longevity; (b) the likelihood of initial defects perforating the container before or shortly after emplacement, and estimates of material defect distribution; (c) the utility of reliability analysis techniques for estimating reliability and life of fuel waste containers; (d) other approaches to estimating container longevity and failure versus time distribution.

43827 (AECL—8566) Microbial mediation of radionuclide transport -significance for the nuclear fuel waste management program. Champ, D.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701958.

The role that microbially catalyzed processes may play in determining, or altering, radionuclide migration is an unresolved question in the Nuclear Fuel Waste Management Program. This report documents the results of a review of the available information on the existence and biochemical capabilities of micro-organisms and the potential for their involvement in processes affecting the migration of radionuclides of interest. The potential was judged sufficient to warrant conducting experiments to assess their role. The outline of an experimental program to address the role of micro-organisms is presented.

43828 (CEA-CONF—7388) New directions in liquid wastes treatment. Alexandre, D. (CEA, 75 - Paris (France)). Aug 1984. 5p. (CONF-840802—30-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751207.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

Published in summary form only.

43829 (CEA-CONF—7389) Vitrification experience and projects in France. Sombret, C.G. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Aug 1984. 10p. (CONF-840802—31). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751208.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

Research on the vitrification of concentrated fission product solutions has been conducted in France for over a quarter of a century. This work has resulted in the formulation of a series of borosilicate glasses applicable to the high-level wastes produced at the Marcoule and La Hague reprocessing plants. The properties of these nuclear glasses permit interim storage and future long-term

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disposal under safe conditions. A continuous vitrification process has also been developed and implemented on an industrial scale at Marcoule since 1978; a larger facility will begin operation at La Hague in late 1986.

43830 (CEA-CONF—7632) **Advanced immobilization processes for fuel hulls and dissolver residues.** Hebel, W.; Boehme, G.; Findlay, J.R.; Sombret, C. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Aug 1984. 7p. (CONF-840802—28). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752077.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

Various research and development projects for the conditioning of cladding scraps and dissolver residues are pursued within the scope of the R and D programme on nuclear waste Management of the European Community. They include the characterization of the waste materials arising from industrial fuel reprocessing and the development of different waste immobilization techniques. These concern the embedment of scraps and residues into inert matrices like cement, metal alloys, compacted graphite and sintered ceramics as well as the treatment of the fuel hulls by melting or chemical conversion. The conditioned waste forms are tested as to their relevant properties for activity enclosure.

43831 (CONF-840806—Vol.1, pp 400-422) **Selected operating results of the PASSAT prototype dissolver offgas cleaning system.** Amend, J.; Furrer, J.; Kaempffer, R. (Nuclear Research Center Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

To test the HEPA filter and iodine sorption filters developed for cleaning the dissolver offgases of a reprocessing plant investigations were performed with iodine and nitrogen dioxide containing offgases at the PASSAT prototype offgas cleaning system. Corrosion caused by iodine in combination with water vapor was found on the components of the offgas cleaning system made of the materials Nos. 1.4541 and 1.4571 and the adhesive used for the HEPA filters was found to resist inadequately nitrogen dioxide. With a view to selecting suitable materials laboratory scale tests were performed under conditions relevant to the plant. Among a number of preselected materials the material No. 1.4563 was found to be the pipe material suited for exposure to iodine containing moist offgases. A material fabricated on the basis of silicone polymer with temperature stabilizing additives proved to be a suited adhesive for HEPA filters.

43832 (CONF-840806—Vol.1, pp 423-433) **Treatment of the off-gas stream from the HTR reprocessing head-end.** Barnert-Wiemer, H.; Juergens, B.; Vijgen, H. (Kernforschungsanlage Juelich GmbH, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The AKUT II-facility (nominal throughput 10 m^3/h, STP) for the clean-up of the burner off-gas has been operated for 20 cold runs in parallel to the JUPITER reprocessing head-end. Two of these runs were continuous operation tests with a duration of 50 and 80 hours, respectively. The facility met or exceeded all design specifications. In a further test series the distillation column alone was run with pure CO_2 and two- and three-component gas mixtures to determine the flooding curves and the stage height (HETP).

43833 (CONF-840806—Vol.1, pp 434-450) **Test results from the GA Technologies engineering-scale off-gas treatment system.** Jensen, D.D.; Olguin, L.J.; Wilbourn, R.G. (GA Technologies Inc., San Diego, CA). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484. Contract AC03-84SF11964.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Test results are available from the GA Technologies (GA) off-gas treatment facilities using gas streams from both the graphite fuel element burner system and from the spent fuel dissolver. The off-gas system is part of a pilot plant for development of processes for treating spent fuel from high temperature gas-cooled reactors (HTGRs). One method for reducing the volume of HTGR fuel prior to reprocessing or spent fuel storage is to crush and burn the graphite fuel elements. The burner off-gas (BOG) contains radioactive components, principally H-3, C-14, Kr-85, I-129, and Rn-220, as well as chemical forms such as CO_2, CO, O_2, and SO_2. The BOG system employs components designed to remove these constituents. Test results are reported for the iodine and SO_2 adsorbers and the CO/HT oxidizer. Integrated testing of major BOG system components confirmed the performance of units evaluated in individual tests. Design decontamination and conversion factors were maintained for up to 72 h. In a reprocessing flowsheet, the solid product from the burners is dissolved in nitric or Thorex acid. The dissolver off-gas (DOG) contains radioactive components H-3, Kr-85, I-129, Rn-220 plus chemical forms such as nitrogen oxides (NO/sub x/). In the pilot-scale system iodine is removed from the DOG by adsorption. Tests of iodine removal have been conducted using either silver-exchanged mordenite (AgZ) or $AgNO_3$-impregnated silica gel (AC-6120). Although each sorbent performed well in the presence of NO/sub x/, the silica gel adsorbent proved more efficient in silver utilization and, thus, more cost effective.

43834 (CONF-840806—Vol.1, pp 451-460) **Experience of iodine removal in Tokai reprocessing plant.** Kikuchi, K.; Komori, Y.; Takeda, K. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Japan). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

In the Tokai reprocessing plant about 170 ton of irradiated fuels have been processed since the beginning of hot operations in 1977. There was no effective equipment for iodine removal from the off-gas except for alkaline scrubbers when the plant construction was completed. In order to reduce the iodine discharge to the atmosphere, silver-exchanged zeolite (AgX) filters were installed additionally in 1979 and 1980, and they have been effective. However, those decontamination factors (DFs) were not as high as expected, and increasing the reprocessing amount of spent fuels it became necessary to lower the iodine discharge to the atmosphere. Therefore, other iodine removal equipment is planned to be installed in the plant. Concerning these investigations and development of iodine removal techniques, the iodine concentration of actual off-gases was measured and useful data were obtained.

43835 (CONF-840806—Vol.1, pp 461-471) **Iodine-129 process control monitor for evaporator off-gas streams.** Burr, J.R.; McManus, G.J. (Westinghouse Idaho Nuclear Co., Idaho Falls). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The continuous monitoring of gaseous ^{129}I in evaporator off-gas at nuclear fuel reprocessing facilities is desirable from both regulatory and process control viewpoints. Although a continuous ^{129}I monitor for nuclear fuel reprocessing plant off-gas streams has already been developed, it needed to be evaluated under evaporator off-gas conditions. Characteristics of the off-gas that pose problems for ^{129}I monitoring include: (1) high concentrations of nitric acid mist, organics, and radionuclides which may interfere with ^{129} detection, such as ^{137}Cs; (2) off-gas that is predominantly water vapor; and (3) ^{129}I in the form of liquid aerosols. The development and evaluation of an ^{129}I monitor for evaporator off-gas using a laboratory-scale evaporator model are reported. The work was performed in two phases: 1) a suitable monitor configuration was determined; and 2) a 2^4 factorial design experiment was performed to determine the monitor's response to HNO_3, organics, aerosols, and ^{137}Cs. A filter was used in the monitor configuration to vary aerosol concentrations. The concentrations of HNO_3, organics, and ^{137}Cs in the evaporator feed were also varied from low to high levels. In the experimental monitor, an H_2O selective permeation device was used to dry the off-gas stream before it passed through a charcoal bed where the iodine was adsorbed. The bed was counted for ^{125}I with a NaI(Tl) detector. Results of this study show that the monitor should be operated with a filter. Based on these observations, the monitor when operated with a filter, was demonstrated to be suitable for use in evaporator off-gas streams.

43836 (CONF-840806—Vol.1, pp 472-494) **Continuous chemical cold traps for reprocessing off-gas purification.** Henrich, E.; Bauder, U.; Steinhardt, H.J.; Bumiller, W. (Kernforschungszentrum Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Absorption of nitrogen oxides and iodine from simulated reprocessing plant off-gas streams has been studied using nitric acid and nitric acid/hydrogen peroxide mixtures at low temperatures. The experiments were carried out at the laboratory and on the engineering scale. The pilot plant scale column has 0.8 m diameter and 16 absorption plates at 0.2 m spacing. Cooling coils on the plates allow operating temperatures down to -60°C. The NO concentration in the feed gas usually has been 1% by volume and the flow rate 4-32 m^3 (STP) per hour. The iodine behavior has been studied using I-123 tracer. Results of the study are presented. The chemistry of the processes and the advantages and disadvantages in correlation to the various applications for an off-gas purification in a reprocessing plant are compared and discussed. The processes are compatible with the PUREX process and do not produce additional waste.

43837 (CONF-840806—Vol.1, pp 495-510) **Development of the ELEX process for tritium separation at reprocessing plants.** Bruggeman, A.; Meynendonckx, L.; Parmentier, C.; Goossens, W.R.A.; Baetsle, L.H. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The ELEX process for isotopic enrichment and separation of tritium from aqueous reprocessing effluents is described. After the development of an appropriate hydrophobic catalyst and the study of the separate constituent steps of the ELEX process, an integrated bench-scale installation with a detritiation capacity of 10 mol water per hour was constructed. It comprises essentially a 1.5 kW electrolyser and two 2 cm diameter by 3 m high exchange columns. In this mini-pilot the ELEX process was successfully demonstrated by detritiating more than 1000 dm^3 water containing up to 100 mCi tritium per dm^3, which is the feed concentration expected for application of the process in a reprocessing plant. The process decontamination factor was always larger than 100 and the overall tritium balance could be kept within the experimental errors of the various measurements. Depending on the duration of the runs, the volume reduction factor was between 10 and 15, but this factor will become much higher when the present electrolyser will be replaced by the low-volume one now under construction at S.C.K./C.E.N. The technical availability of the mini-pilot amounted to 99% or more for the last experiments. During the nearly 6000 hours of operation there were no tritium contamination problems. At present the construction of a 280 $mol.h^{-1}$ or 0.12 m^3 H_2O (HTO) per day pilot detritiation installation nears completion. In this unit, which will have a total tritium inventory of maximum 1000 Ci, the ELEX process will be demonstrated with a volume reduction factor of 100 and a process decontamination factor of 100. Again the feed concentration will be 100 Ci tritium per m^3. In the future this installation will be supplemented with a pre-treatment unit for the removal of fission products, organics and nitric acid.

43838 (CONF-840806—Vol.1, pp 667-682) **Choice of materials for the immobilization of 85-krypton in a metallic matrix by combined ion implantation and sputtering.** Whitmell, D.S. (United Kingdom Atomic Energy Authority, Harwell, England). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Immobilization in a metal matrix by combined ion implantation and sputtering promises to offer an ideal method for the containment of krypton-85 arising from the reprocessing of nuclear fuel. A 50 kW inactive pilot plant has been built and operated to prepare a copper deposit 22 mm thick weighing 23 kg and containing over 30 liters of inactive gas. The gas incorporation rate exceeded the design figure of 0.3 liters/hour and the vessel was operated at powers up to 30 kW, which corresponds to that envisaged for the industrial vessel. The power consumption was less than 100 kWh/liter. A full-scale vessel (1 m long, 0.26 m diameter) has also been tested at low power. Samples of alternative candidate materials: stainless steel, incoloy, nickel and nickel-lanthanum have been prepared and tested. Nickel appears to be the most promising since it incorporates gas with an efficiency 70% greater than copper and also retains the gas to a temperature at least 100°C higher than copper. Tests are being carried out with 100 Curies of radioactive krypton in order to demonstrate that the process will operate satisfactorily at the high internal β irradiation levels that will exist in an active plant and to prepare samples containing krypton-85 for long term leakage measurements and for assessment of any effects caused by the build-up of the decay product rubidium.

43839 (CONF-840806—Vol.1, pp 755-760) **Summary of US activities in commercial nuclear airborne waste management.** Groenier, W.S. (Oak Ridge National Lab., TN). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484. Contract AC05-84OR21400.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Most of the US nuclear air cleaning technology development in recent years has addressed advanced retention concepts in response to environmental concerns. In particular, efforts have centered in the fuel reprocessing portion of the nuclear fuel cycle. Although generally well developed on a cold engineering scale, the individual retention steps for ^3H, ^{14}C, ^{85}Kr, and ^{129}I) must yet be demonstrated in an active integrated facility. Fixation and disposal technologies for retained airborne constituents are generally less well developed.

43840 (CONF-840806—Vol.1, pp 761-774) **Research and development on air cleaning system of reprocessing plant in Japan.** Naruki, K. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Japan). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Present status in Japan of R and D on air cleaning systems, especially of the fuel reprocessing plant is summarized. The description is centered on the R and D and experience of Tokai-reprocessing plant, which covers the plant air cleaning system, effort carried out for decreasing I_2 effluence in the actual vented off-gas, and R and D for recovery of Kr and ^3H. Some experimental results for the evaluation of HEPA filter are also described.

43841 (CONF-840806—Vol.1, pp 775-779) **Status of R and D in the field of nuclear airborne waste sponsored by the European Community.** Hebel, W. (Commission of the European Communities, Brussels, Belgium). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

An overall review is given on the research activities that have been supported by the European Community for the last 8 years in the field of management of radioactive gaseous waste. The major subjects of concern are management possibilities for krypton-85, iodine-129, carbon-14 and tritium. After a short introduction to the kind and contents of this specific research activity, summary statements are given successively for each of the four radionuclides concerning the state of development not achieved within the scope of the joint program.

43842 (CONF-840806—Vol.1, pp 780-801) **Development of technologies for the waste management of I-129, Kr-85, C-14 and tritium in the Fed. Rep. of Germany.** Henrich, E.; Ebert, K. (Kernforschungszentrum Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The main source of I-129, Kr-85, C-14 and tritium in Germany will be a 10-15 GWe LWR fuel reprocessing plant (FRP), expected to be in operation in the mid nineties. Guidelines for release regulations and development efforts are discussed. It has been recommended to limit the annual I-129 release to less than 0.2 curie. The uncontrolled release of Kr-85, C-14 or tritium via the stack re-

sulting from the 15 GWe power will not exceed the limits derived from the German radiation protection ordinary. The development and hot demonstration of a Kr-85 control technology is recommended in view of the anticipated increasing use of nuclear power in the future. Commercial use of Xe and Kr may also contribute to the incentive for recovery. It would be simple to recover $14CO_2$ once separated in the course of the I-129 or Kr-85 removal operations. Tritiated waste water once it has been separated in the course of processing, should not be deliberately released. Therefore, tritium control technology is being developed. General concepts and the present status of reference and back-up technologies as well as additional research in view of advanced processes are summarized.

43843 (CONF-840806—Vol.1, pp 683-701) **Off-gas treatment and characterization for a radioactive in situ vitrification test.** Oma, K.H.; Timmerman, C.L. (Pacific Northwest Lab., Richland, WA). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484. Contract AC06-76RL01830.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Effluents released to the off gas during the in situ vitrification (ISV) of a test site have been characterized. The site consisted of a 19 L waste package of soil containing 600 nCi/g transuranic and 30,000 nCi/g mixed fission products surrounded by uncontaminated soil. Radioactive isotopes present in the package were ^{241}Am, /sup 238/239/Pu, ^{137}Cs, ^{106}Ru, ^{90}Sr, and ^{60}Co. The ISV process melted the waste package and surrounding soil and immobilized the radionuclides in place, producing a durable, 8.6 metric ton glass and crystalline monolith. The test successfully demonstrated that the process provides containment of radioactive material. No release to the environment was detected during processing or cooldown. Due to the high temperatures during processing, some gases were released into the off-gas hood that was placed over the test site. The hood was maintained at a light negative pressure to contain any volatile or entrained material during processing. Gases passed from the hood to an off-gas treatment system where they were treated using a venturi-ejector scrubber, a tandem nozzle gas cleaner scrubber followed by a condenser, heater, and two stages of HEPA filters. The off-gas treatment system is located in the semi-trailer to allow transport of the process to other potential test sites. Retention of all radionuclides by the vitrified zone was greater than 99%. Soil-to-off-gas decontamination factors (DFs) for transuranic elements averaged greater than 4000 and for fission products, DFs ranged from 130 for ^{137}Cs to 3100 for ^{90}Sr.

43844 (CONF-840806—Vol.1, pp 702-731) **Behavior of ruthenium, cesium and antimony during simulated HLLW vitrification.** Klein, M.; Weyers, C.; Goossens, W.R.A. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The behavior of ruthenium, cesium, and antimony during the vitrification of simulated high-level radioactive liquid wastes (HLLW) in a liquid fed melter was studied on a laboratory scale and on a semi-pilot scale. In the laboratory melter of a 2.5 kg capacity, a series of tests with the simulate traced with ^{103}Ru, ^{134}Cs and ^{124}Sb, has shown that the Ru and Cs losses to the melter effluent are generally higher than 10% whereas the antimony losses remain lower than 0.4%. A wet purification system comprising in series, a dust scrubber, a condenser, an ejector venturi and an NOx washing column retains most of the activity present in the off-gas so that the release fractions for Ru at the absolute filter inlet ranges between 5.10^{-3} to 5.10^{-5}% of the Ru fed, for Cs the corresponding release fraction ranges between 3.10^{-3} to 10^{-4}% and for Sb the release fraction ranges between $1.7\ 10^{-4}$ to $1.7\ 10^{-5}$%. The same experiments were performed at a throughput of 1 to 2 l h^{-1} of simulated solution in the semi-pilot scale unit RUFUS. The RUFUS unit comprises a glass melter with a 50 kg molten glass capacity and the wet purification train comprises in series a dust scrubber, a condenser, an ejector venturi and an NOx washing column. The tracer tests were restricted to ^{103}Ru and ^{134}Cs since the laboratory tests had shown that the antimony losses were very low. The results of the tests are presented.

43845 (CONF-840806—Vol.2, pp 873-894) **Calculating released amounts of aerosols.** Nagel, K.; Furrer, J. (Kernforschungszentrum Karlsruhe GmbH, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

PASSAT is a test facility to remove iodine isotopes and aerosols from dissolver off-gas. It is located at the Nuclear Research Center Karlsruhe (LAF II). On the basis of experimental results coming from PASSAT the aerosol retention of the dissolver off-gas has been modelled for a large reprocessing plant. The experimental performance to get results for the wave-plate droplet separator and packed fiber mist eliminator (PFME) is described in detail. Theoretical considerations about the aerosol retention factor of the droplet separator have to be changed to reconcile these considerations with the experimental results. The decontamination factor of PFME could be approximated as a function of aerosol diameter and gas flow rate. On the assumption of 10 mg/Std.m^3 in total mass of aerosols and three different frequency distributions in the aerosol diameter the released amount of aerosols was calculated.

43846 (CONF-840806—Vol.2, pp 938-950) **Alternative modes for cryogenic krypton removal.** Geens, L.P.; Goossens, W.R.A.; Collard, G.E.R. (S.C.K./C.E.N., Mol, Belgium). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

In the past, oxygen elimination was considered as a necessary pretreatment before cryogenic krypton removal from reprocessing off-gases. In this view, the catalytic reduction of oxygen with hydrogen was investigated in the DEOXO unit, in which a Pd and a Ru catalyst were used. At a gas flow rate of 30 $Nm^3.h^{-1}$ and an oxygen feed concentration up to 15% volume, the oxygen content in the feed gas of the cryogenic unit could be reduced to 0.5 ppm volume. For the following experiments, the DEOXO unit was connected in series with an adsorption drier and the cryogenic distillation unit. No technical problems arose during the 80 hours run. Furthermore, no significant build-up of an oxygen-rich layer in the cryogenic rectification column was observed. At present, increased attention has been devoted to krypton removal in the presence of air. In that perspective, the study of the selective catalytic reduction of NO/sub x/ with ammonia in the DENITRO unit becomes part of the flowsheet. With the use of a H-mordenite catalyst and an ammonia excess of 30%, the NO/sub x/ concentration in a 25 $Nm^3.h^{-1}$ gas stream could be reduced from more than 1% volume to lower than 1 ppm volume. The oxygen behavior in the cryogenic distillation unit was also investigated. Oxygen analyses were performed to gain information on the oxygen distribution in the column. Although an oxygen rich layer was built up in the column, the krypton-xenon bottom product contained less than 0.1 ppm volume oxygen, so that no oxygen was transferred to the second column. This favorable oxygen behavior, combined with the feasibility of the selective catalytic NO/sub x/ reduction is promising for the cryogenic krypton retention in the presence of oxygen.

43847 (CONF-840806—Vol.2, pp 951-958) **Behavior of impurities in a cryogenic krypton removal system.** von Ammon, R.; Bumiller, W.; Hutter, E.; Knittel, G.; Mas, C.; Neffe, G. (Kernforschungszentrum Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Two radiolytic reactions which may take place in the cryogenic columns of a Kr-85 removal system in the off-gas cleaning system of reprocessing plants were simulated in the inactive test unit KRETA: formation of ozone from O_2 and of nitrogen oxides from O_2 and N_2. The reactions were simulated by adding O_3 and NO + O_3 to the feed gas, respectively. Whereas accumulation of O_3 in the first column is not critical, it can reach concentrations in the percent range between the krypton and xenon sections of the second column. NO reacts with O_2 rapidly at low temperatures to N_2O_3 and N_2O_4. The solubility of N_2O_4 in liquid xenon has been determined to be about 1 mole-% at 200 K in a laboratory study. Crystallization of moderate amounts of N_2O_4 in the sump does not

cause column malfunctions. However, if N_2O_4 crystallizes in the feed gas section of the column, plugging of sieve plates may occur. It was found that CH_4 and other hydrocarbons can be removed from the off-gas by oxidation with H_2O vapor even in an atmosphere containing excess H_2 for the reduction of O_2 and NO/sub x/. For complete removal of CH_4 temperatures of ≧500°C must be maintained.

43848 (CONF-840806—Vol.2, pp 959-981) **Selective absorption of noble gases in freon-12 at low temperatures and atmospheric pressure.** Henrich, E.; Huefner, R.; Weirich, F.; Bumiller, W.; Wolff, A. (Kernforschungszentrum Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

A selective absorption process for the removal of noble gases from the dissolver off-gas in a reprocessing plant is under development. The process uses freon-12 as the solvent and operates at low temperatures and atmospheric pressure. The solubility of various off-gas components (N_2, O_2, Ar, Kr, Xe, CH_4, N_2O, CO_2, NO) has been determined at temperatures between -158°C and -30°C as a basis for modelling the process, which operates with two absorption columns. The inactive Xe plus small amounts of 14-CO_2, N_2O and traces of Rn are absorbed in the first column at absorption temperatures of about -120°C. The radioactive Kr is removed in the second column at absorption temperatures of about -150°C. The feed-gas to the first absorption column is sub-cooled to prevent the carry-over of impurities. The process has been tested in a 2.5 cm diameter lab-scale column before an engineering scale column of 10 cm diameter and 12 m height has been constructed and operated. The throughput of the later column is 25 m^3 (STP) off-gas per hour. The essential results of the test runs are summarized. Consequences of radiolytic solvent degradation were estimated, using experimental results obtained under process conditions. The selective absorption equipment is part of an integrated dissolver off-gas system on an engineering scale.

43849 (CONF-840806—Vol.2, pp 982-995) **Chromatographic separation of krypton from dissolver off-gas at low temperatures.** Ringel, H.; Messler, M. (Kernforschungsanlage Juelich, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Separation of krypton from dissolver off-gas by adsorption on solid adsorbers was experimentally investigated. The principle of the developed process consists of adsorption on activated charcoal and separation of the different gas species by purging the charcoal with helium. Different process variations in regard to adsorption pressure and column temperature are compared with each other. For hot cell application a process with gas adsorption at -150°C and nominal pressure seems to be most suitable. In this case and for an off-gas flow rate of 100 m^3 STP/h the whole column volume for a continuous operating process is about 300 l charcoal and the helium purge flow rate is 8 m^3 STP/h. Among other parameters the influences of the off-gas composition and fluctuations of the noble gas content have been investigated.

43850 (CONF-840806—Vol.2, pp 1004-1018) **Krypton control alternatives.** Henrich, E.; von Ammon, R.; Ebert, K. (Kernforschungszentrum Karlsruhe, West Germany). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

A reprocessing plant for 350 metric tons per year LWR spent fuel cooled for at least 7 years is planned in the FRG. A routine Kr-85 retention for radiation protection reasons is not demanded by the German reactor safety and radiation management technology for larger plants in the future. The licensing authorities also do not require a routine Kr-85 retention at the plant site. Technical and safety characteristics of various Kr-85 removal processes are described and compared, including the precleaning steps in an integrated dissolver off-gas system. The interactions with subsequent conditioning and storage of Kr and with process modifications in the plant headend are also taken into account. A commercial use of the inactive Xe and part of the Kr-85 may have an influence on a cost-benefit analysis and the selection of a removal process. Two alternative processes are being developed on an engineering scale. A cryogenic distillation process using an O_2-free off-gas is under investigation on a pilot plant scale since 1976. A selective absorption process using freon-12 at low temperatures and at atmospheric pressure has been investigated at the laboratory scale since 1980. Test operation on an engineering scale started late in 1983. Essential results and operating experiences with both facilities are summarized. Technical as well as safety aspects are in favor of the selective absorption process. A final decision on what process will be used in the future shall be made as soon as comparable technical experiences from both processes are available.

43851 (CONF-840806—Vol.2, pp 1258-1282) **NO/sub x/ removal from nuclear fuel reprocessing plants off gas by catalytic reduction with NH_3.** Hattori, S.; Kobayashi, Y.; Katoh, Y.; Takimoto, Y.; Kunikata, M. (Central Research Institute of Electric Power Industry, Tokyo, Japan). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The selective reduction of NO/sub x/ with NH_3 was investigated, using several kinds of titania catalysts and hydrogen mordenite (Hz, zeolite catalyst), as a basic study of the treatment of off gas generated in nuclear reprocessing plants, which was supposed to contain about 30% of O_2 and a relatively large amount of NO_2. N_2O was remarkably formed regardless of the types of catalysts when the NO_2/NO/sub x/ ratio was higher than 0.5. On the other hand, N_2O was hardly formed when Hz and certain kinds of titania catalysts were used at NO_2/NO/sub x/ ratios below 0.5. It has been concluded that these kinds of catalysts were suitable and that the NO/sub x/ should be decomposed according to the following reaction: $NO + NO_2 + 2NH_3 \rightarrow 2N_2 + 3H_2O$. Therefore, it is effective to decompose NO_2 thermally to NO in the first step, to depress the formation of N_2O when the NO_2/NO/sub x/ ratio of the gas to be treated is higher than 0.5. Hz has catalytic abilities not only to reduce N_2O with NH_3 but also to decompose NH_3, which means that a one reaction system of NO/sub x/ removal can be carried out for NO_2 rich gases.

43852 (CONF-840806—Vol.2, pp 1318-1342) **Development of a method to determine iodine specific activity in process off-gases by GC separation and negative ionization mass spectrometry.** Fernandez, S.J.; Rankin, R.A.; McManus, G.J.; Nielson, R.A. (Westinghouse Idaho Nuclear Co., Idaho Falls). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The development of a method for determining the iodine specific activity emitted from a nuclear fuel reprocessing plant is described. The technique includes cryogenic sample collection, chemical form separation, quantitation by gas chromatography and specific activity measurement by negative ionization mass spectrometry. The major conclusions were that both organic and elemental iodine can be quantitatively collected without fractionation and that specific activity measurements as low as one atom of ^{130}I per 10^5 atoms of ^{127}I are possible.

43853 (CONF-840806—Vol.2, pp 1343-1360) **Removal of iodine from off-gas of nuclear fuel reprocessing plants with silver impregnated adsorbents.** Hattori, S.; Kobayashi, Y.; Ozawa, Y.; Kunikata, M. (Central Research Institute of Electric Power Industry, Tokyo, Japan). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Silver impregnated adsorbents such as silver zeolite, silver mordenite, silver alumina and silver silica gel were compared on the basis of their I_2 and CH_3I adsorption characteristics under the simulated dissolver off gas stream conditions. For silver zeolite and silver mordenite, having carrier pore sizes less than 10 A, the same amounts of adsorbed iodine were found to desorb reversibly and to be affected by the presence of NO/sub x/ and H_2O impurities. On the other hand, no effects due to NO/sub x/ and H_2O were observed on iodine adsorption for silver alumina and silver silica gel,

having carrier pore sizes larger than 100 A. After regeneration by hydrogen gas at 500°C, the amounts of CH_3I adsorbed decreased markedly for silver zeolite, silver alumina, and silver silica gel. This was understood to be due to the formation of metallic silver. Those metallic silver impregnated adsorbents could hardly react with CH_3I. However, NO/sub x/ and H_2O had effect to increase adsorption capacity. Seven cyclic regeneration tests indicated that both silver alumina and silver silica gel kept their capacity for I_2 adsorption.

43854 (CONF-840806—Vol.2, pp 1470-1477) **Spring loaded hold-down for mounting HEPA filters at Rocky Flats.** Terada, K.; Rose, C.R.; Garcia, A.G. (Rockwell International, Golden, CO). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The use of springs to maintain pressure on the gasket to form an air tight seal between HEPA filters and their holders is described.

43855 (CONF-840806—Vol.2, pp 1361-1377) **Volatile ruthenium trapping on silica gel and solid catalysts.** Cains, P.W.; Yewer, K.C. (Atomic Energy Research Establishment, Harwell, England). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012485.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Packed bed investigations have shown silica gel to be unsuitable as a material for trapping residual volatile ruthenium in high-level waste vitrification off-gas treatment. Desorptive migration of ruthenium trapped on silica gel has been observed with continuing gas flow when the ruthenium concentration is reduced; the nature of this migration suggests that a release from the bed would occur after a very short time. Subsequent work has concentrated on supported transition metal/oxide catalysts, with the aim of identifying materials that both effectively trap and subsequently retain volatile ruthenium species by promoting their decomposition to stable, solid RuO_2. Four such materials have been shortlisted to undergo further examination.

43856 (CONF-850612—6) **Impacts of atmospheric tritium releases from solid waste storage areas.** Kornegay, F.C. (Oak Ridge National Lab., TN (USA)). Mar 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016407.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

Burial sites for low-level radioactive wastes are situated on the Oak Ridge National Laboratory (ORNL) reservation. Releases of radioactive material from these sites into the ground- and surface waters, thus affecting nearby residents, has long been a concern. Such releases are considered the primary pathway of concern from low-level burial sites in humid regions. However, recent publications indicate that the atmospheric pathway, through which tritiated water vapor, ^{14}C, ^{85}Kr, ^{222}Rn, and possibly other gases are emitted the trenches, dispersed downwind, and inhaled, may be an important impact from some low-level burial sites. This paper represents an attempt to estimate the atmospheric contribution from the ORNL burial grounds, specifically the Solid Waste Storage Areas (SWSAs), to the total dose commitment resulting from ORNL burial ground operations. The results of this study indicate that tritium released from the ORNL SWSAs is not a significant contributor to the offsite dose received as a result of ORNL operations. The assumptions used in this study are conservative, but some additional work may be required before the problem can be dismissed. 8 refs.

43857 (DOE/CH/10140—4) **Salt Repository Project: FY 85 technical project plan.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jul 1985. Contract AC02-83CH10140. 99p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016323.

The FY 85 technical plan for the Salt Repository Project is briefly presented. The objectives of the project in relation to the Civilian Radioactive Waste Management Program are discussed, and the technical activities directed toward accomplishing these objectives are detailed. A budget is presented for each of the Level 2 work breakdown structure tasks (Systems, Waste Package, Site, Repository, Regulatory and Institutional, Exploratory Shaft, Test Facilities, Land Acquisition, and Project Management) in the various sections. An overall description, current status, and planned activities are presented for each of the subtasks which make up the above-mentioned Level 2 tasks. A strategy diagram and a master schedule are included and each of the milestones is also listed chronologically in the sections.

43858 (EPRI-NP—4037) **Radionuclide correlations in low-level radwaste. Final report.** Best, W.T.; Miller, A.D. (Impell Corp., Walnut Creek, CA (USA)). Jun 1985. 348p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920831.

This final report describes the work that was done to assist the nuclear industry in complying with the classification requirements listed in 10CFR61, "Licensing Requirements for Land Disposal of Radioactive Waste." This work included a sampling and analytical programs at four light water reactors, collection of data from all available sources, and statistical interpretation of these data. A scaling factor methodology is proposed and data for its implementation are presented. Generic scaling factors are reported for use in determining Ni-63 based on Co-60 and for determining relative transuranic activities based on Pu-239. Data are also presented supporting simplified requirements for regulatory compliance. The entire database is presented as appendices to this report.

43859 (IAEA-WMRA—15) **Waste management research abstracts No. 15.** (International Atomic Energy Agency, Vienna (Austria)). Oct 1984. 340p. NTIS (US Sales Only), PC A15/MF A01. File Number DE85702032.

The 15th issue of Waste Management Research Abstracts collects and disseminates information on research in progress in the field of nuclear waste management in IAEA Member States.

43860 (INFO—0099) **Uranium tailings in Canada. Regulation and management.** Boulden, R.S.; Bragg, K. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 12 Sep 1982. 10p. (CONF-820933—11). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702036.

From International conference on radioactive waste management; Winnipeg, Manitoba, Canada (12 Sep 1982).

The last few years have produced significant changes in the way uranium tailings are managed in Canada. This is due both to the development of new technology and to changes in regulatory approach. The interrelationships between these two areas are examined with particular attention paid to the long term and the development of close-out criteria. New technological initiatives are examined including dry placement techniques, pit disposal and deep lake disposal.

43861 (NUREG/CP—0062, pp 77-80) **Neptunium and technetium behavior in geological systems.** Meyer, R.E.; Kelmers, A.D.; Arnold, W.D.; Johnson, J.S.; Kessler, J.H.; Clark, R.J.; Young, G.C.; Case, F.I.; Westmoreland, C.G. (Oak Ridge National Lab., TN). Apr 1985. NTIS, PC A06/MF A01 - GPO. File Number TI85009817. (CONF-8410234—Summs.; ORNL/TM—9585). Contract AC05-84OR21400.

From Application of geochemical models to high-level nuclear waste repository assessment; Oak Ridge, TN, USA (2 Oct 1984).

Technetium, if present in groundwaters as the TcO_4^- ion, will not adsorb significantly on the minerals normally encountered in geological formations. Neptunium(V) has been reported to adsorb to some extent, but reported sorption ratios are sometimes as low as 0.5 L/kg. A number of investigators have suggested that if Tc(VII) and Np(V) are reduced, then the expected lower solubilities of the lower valence states might significantly reduce the potential rate of migration of these nuclides. There is also evidence that the lower valence forms of these elements may tend to be more highly adsorbed on geological components than the oxidized valence states. Thus, performance of these two nuclides in high

level waste repositories may be dependent on whether reduction to a lower valence state actually occurs under repository geochemical conditions and whether the solubilities of the reduced species are as low and sorption as high as expected.

43862 **(NUREG/CR—4352) Suggested state requirements and criteria for a low-level radioactive waste disposal site regulatory program.** Ratliff, R.A.; Dornsife, B.; Autry, V.; Gronemyer, L.; Vaden, J.; Cashman, T. (Conference of Radiation Control Program Directors, Inc., Frankfort, KY (USA)). Aug 1985. 47p. NTIS, PC A03/MF A01 - GPO. File Number TI85902093.

Description of criteria and procedure is presented for a state to follow in the development of a program to regulate a LLW disposal site. This would include identifying those portions of the NRC regulations that should be matters of compatibility, identifying the various expertise and disciplines that will be necessary to effectively regulate a disposal site, identifying the resources necessary for conducting a confirmatory monitoring program, and providing suggestions in other areas which, based on experiences, would result in a more effective regulatory program.

43863 **(ONWI—290) Geologic characterization report for the Paradox Basin Study Region, Utah Study Areas. Volume 6. Salt Valley.** (Woodward-Clyde Consultants, San Francisco, CA (USA)). Dec 1984. Contract AC02-83CH10140. 221p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85011699.

Surface landforms in the Salt Valley Area are generally a function of the Salt Valley anticline and are characterized by parallel and subparallel cuestaform ridges and hogbacks and flat valley floors. The most prominent structure in the Area is the Salt Valley anticline. Erosion resulting from the Tertiary uplift of the Colorado Plateau led to salt dissolution and subsequent collapse along the crest of the anticline. Continued erosion removed the collapse material, forming an axial valley along the crest of the anticline. Paleozoic rocks beneath the salt bearing Paradox Formation consist of limestone, dolomite, sandstone, siltstone and shale. The salt beds of the Paradox Formation occur in distinct cycles separated by an interbed sequence of anhydrite, carbonate, and clastic rocks. The Paradox Formation is overlain by Pennsylvanian limestone; Permian sandstone; and Mesozoic sandstone, mudstone, conglomerate and shale. No earthquakes have been reported in the Area during the period of the historic record and contemporary seismicity appears to be diffusely distributed, of low level and small magnitude. The upper unit includes the Permian strata and upper Honaker Trail Formation. The current data base is insufficient to estimate groundwater flow rates and directions in this unit. The middle unit includes the evaporites in the Paradox Formation and no laterally extensive flow systems are apparent. The lower unit consists of the rocks below the Paradox Formation where permeabilities vary widely, and the apparent flow direction is toward the west. 108 refs., 39 figs., 9 tabs.

43864 **(ORNL/TM—9730) Bibliographic citations pertinent to the Weldon Spring Site, St. Charles County, Missouri.** Owen, P.T.; Michelson, D.C.; Knox, N.P. (comps.). (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016910.

This report is a compilation of 166 bibliographic references pertinent to the Weldon Spring Site (WSS), St. Charles County, Missouri. The WSS is a surplus US government facility which consists of the Weldon Spring Chemical Plant; two separate low-level radioactive waste storage properties, designated the "raffinate pits" and "quarry", and a number of potentially contaminated vicinity properties. The facility was used by the US Atomic Energy Commission from 1957 to 1966 to refine uranium. After several years the US Department of the Army acquired responsibility for the Weldon Spring Chemical Plant, performed some limited radiological decontamination, and then cancelled plans to construct a chemical process. Contamination of the facility and adjacent lands resulted from operation of the refining facility and the storage, transport, and disposal of process wastes on the property, as well as subsequent decontamination activities. All identified references to published technical documents that relate to the WSS were included in this report. In some cases citations from the reference section of existing documents were included in this report with no hardcopy to substantiate the existence of the document referenced.

43865 **(PB—85-202976/XAB) Nuclear waste management and the use of the sea. Special report.** (National Advisory Committee on Oceans and Atmosphere, Washington, DC (USA)). Apr 1984. 106p. NTIS, PC A06/MF A01.

This report reviews the current situation on nuclear waste disposal policies in the United States and elsewhere and relates these policies to implications for the oceans. The report does not comment on nuclear power as an energy source. In a comprehensive background information section, the report describes the worldwide inventory of radioactive waste, the varying types of radioactive wastes, international and domestic laws governing radioactive waste disposal, scientific analysis of marine radioactivity, and possible U.S. proposals on ocean disposal of nuclear waste. Detailed appendices describe nuclear and health physics, waste management strategies of other nations, prior U.S. dumping of radioactive wastes, signatories to the London Dumping Convention, specific case histories, among others.

43866 **(PER—84) Summary of investigations carried out prior to 19 October 1984 regarding the location of the Vaalputs radioactive waste disposal site for the burial of intermediate and low-level waste.** Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Oct 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701963.

Includes maps.

A recommendation by a specialist study group that the State set in motion a program to locate a suitable site or sites for the storage/disposal of radioactive waste in South Africa was accepted in 1978. A site-selection program was therefore duly initiated and in February 1983 culminated in the purchase of three farms, Garing, Geelpan and Stofkloof, some 100 km south-southeast of the town of Springbok in the northwestern Cape. The site, known as Vaalputs, is about 10,000 ha in extent. Detailed geological, geophysical, geohydrological, geobotanical, geomorphological and environmental investigations have been completed, with emphasis on the Geelpan Block, previously recommended as being the most suitable area for a disposal site. The final site of 0,5 x 0,7 km has now been selected.

43867 **(PNL-SA—13093) Radiation effects in actinide host phases.** Weber, W.J.; Matzke, H. (Pacific Northwest Labs., Richland, WA (USA); Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). May 1985. Contract AC06-76RL01830. 15p. (CONF-850781—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016273.

From International conference on radiation effects in insulators; Guildford, Surrey, UK (15 Jul 1985).

Three crystalline ceramic materials, which occur as host phases for the long-lived actinides in many nuclear waste formulations, were doped with Cm-244, and the effects of self-radiation damage from alpha decay on microstructure and physical properties were investigated. The irradiation-induced microstructure consisted of individual amorphous tracks from both the alpha-recoil particles and the spontaneous fission fragments. The eventual overlap of the tracks at higher doses leads to a completed amorphous state. This radiation-induced amorphization process results in a stored energy of ~125 J/g, 5 to 10% swelling, factor of 10 to 50 increase in leachability (aqueous dissolution), and in increase in fracture toughness. 17 refs., 6 figs.

43868 **(RFP—3826) Plutonium removal from aqueous solution via activated commercial magnetites.** Kochen, R.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 15 Apr 1985. Contract AC04-76DP03533. 16p. (CONF-8505139—9). NTIS, PC A02/LMF A01; 1; GPO Dep. File Number DE85013216.

From 9. annual actinide separations workshop; Richland, WA, USA (22 May 1985).

An improved ferrite waste treatment process was found by activating and increasing the adsorption characteristics of commercial magnetite. Barium hydroxide [$Ba(OH_2)$ x $8H_2O$], barium oxide

(BaO), and strontium hydroxide [$Sr(OH)_8 \times 8H_2O$] were all found to be effective magnetite activating agents. Barium hydroxide-activated magnetite showed plutonium removal from aqueous solution by four orders of magnitude. About thirty-three percent more non-activated magnetite was required to obtain comparable plutonium removal. 7 refs.

43869 (RHO-HS-SR—84-1-P) Rockwell Hanford Operations effluents and solid waste burials during calendar year 1984. Bihl, D.E.; Aldrich, R.C.; Stanfield, L.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jul 1985. Contract AC06-77RL01030. 157p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85015555.

Rockwell Hanford Operations (Rockwell) activities general solid, liquid and gaseous wastes that must be discharged to the environment or stored or disposed of onsite. The quantities of solid, liquid, or gaseous wastes buried or discharged during calendar year 1984 are tabulated. No liquid or solid wastes are discharged offsite. In calendar year 1984, no effluents exceeded DOE-HQ limits. 8 refs., 1 fig., 13 tabs.

43870 (RHO-RE-SA—95P) Plutonium dissolution from Rocky Flats Plant incinerator ash. Delegard, C.H. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jun 1985. Contract AC06-77RL01030. 41p. (CONF-8505139—7). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017053.

From 9. annual actinide separations workshop; Richland, WA, USA (22 May 1985).

Rockwell Hanford Operations (Rockwell) soon will commence recovery of plutonium from Rocky Flats Plant incinerator ash. In preparation for this processing, Rockwell undertook literature and laboratory studies to identify, select and optimize plutonium dissolution methods for treating the ash. Ash reburning, followed by dissolution in nitric acid containing calcium fluoride, was selected as the processing method for the ash. Recommended values of process parameters were identified. Using the selected process, 99.5% plutonium recovery was achieved, leaving about 12.7 wt % heel residue for an equal weight composite of the three ashes tested. 15 refs., 26 figs.

43871 (SAND—83-1327) Grain density measurements of ash flow tuffs: an experimental comparison of water immersion and gas intrusion pycnometer techniques. Schwartz, B.M. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017329.

The Nevada Nuclear Waste Storage Investigations (NNWSI) Project is currently investigating tuff formations at the Nevada Test Site for feasibility as a repository site. Grain density measurements are routinely made on tuff samples obtained from cored exploratory holes and are used in conjunction with mineralogical data, downhole density logs, and lithologies to define a thermal/mechanical stratigraphy. Grain densities are used directly in the calculation of porosity and in the interpretation of the variation seen in thermal and mechanical properties. Standardized grain density procedures such as ANSI/ASTM or API do not address the problems of testing hygroscopic minerals such as clays and zeolites that commonly occur in silicic tuffs. This report compares two widely used techniques for measuring grain density: water immersion and gas intrusion. It also describes sample-handling and operating procedures necessary for repeatable grain density measurements of zeolitized and claybearing tuffaceous rocks. Laboratory tests included in this report show the importance of careful sample-handling on the acquisition of accurate and repeatable data. Without consistent thermal pretreatment of hygroscopic tuff samples, grain densitites determined by either method can vary by as much as 10% due to the loss or gain of adsorbed water. Repeatable data are obtained only when pretest sample-handling procedures are both defined and rigorously followed. These data indicate that both techniques are probably sufficiently accurate and precise for most project needs. However, water pycnometer data have a higher level of precision for both zeolitized and nonzeolitized tuff samples than do gas pycnometer data. 10 refs., 4 figs., 5 tabs.

43872 (SAND—84-0288, pp 109-110) Trace constituents in evaporites. Livingston, D.E. (Dept. of Energy, Grand Junction, CO). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

43873 (SAND—84-1390C) Planning, developing, and organizing in situ tests for the Waste Isolation Pilot Plant (WIPP). Matalucci, R.V.; Munson, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 32p. (CONF-850938—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016195.

From 2. conference on the mechanical behavior of salt; Hannover, F.R. Germany (24 Sep 1985).

The US Department of Energy (DOE) is developing the WIPP Project in southeastern New Mexico as a research and development (R and D) facility to demonstrate the safe disposal of radioactive wastes in bedded (layered) salt. This project provides for an in situ testing facility to address the technical issues of repository development, waste package performance assessment, and waste handling demonstrations. In situ tests (a part of the R & D program) were designed to verify laboratory data and theoretical analyses. This report documents the planning and development activities associated with the WIPP In Situ Testing Program. It describes the procedures followed during design, construction, and installation of the underground thermal/structural interactions, plugging and sealing, waste package performance, and operational demonstration tests. To successfully achieve this in situ test installation program required continuous coordination of Sandia's R & D testing requirements with the technical supporting activities of the other WIPP participants. 13 refs., 16 figs.

43874 (SAND—84-2354) Structural analysis of the NNWSI Exploratory Shaft. Hill, J. (New Mexico Engineering Research Inst., Albuquerque (USA)). Jun 1985. Contract AC04-76DP00789. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017327.

The Exploratory Shaft is the first step involving mining at the actual geologic horizon of the proposed Nevada Nuclear Waste Repository. A three-dimensional finite element analysis of the Exploratory Shaft and a two-dimensional finite element analysis of an exploratory shaft cross section were performed to determine if excavation loads would produce any structural problems with the Exploratory Shaft. For the low extraction ratio seen in the Exploratory Shaft, it was not expected that the rock would be overstressed. The analyses confirmed this notion. Both studies showed that the lowest factors of safety against intact rock failure exceeded 4.0. The results should serve to aid in experimentation by providing information about the displacements and the stress fields expected in the excavated tunnels. 5 refs., 20 figs., 2 tabs.

43875 (SAND—85-0056) Rock-salt mine saw. Staller, G.E.; Wilson, W.C.; Smith, A.R. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017342.

A saw has been developed for cutting rock salt at the Waste Isolation Pilot Plant near Carlsbad, NM. This saw uses commercially available hardware in conjuction with Sandia-designed equipment. It has been used to cut rock salt in situ as well as samples removed from the mine.

43876 (SAND—85-0261C) Evaluation of the accuracy of continuum-based computational models in relation to field measurements in welded tuff. Zimmerman, R.M.; Blanford, M.L. (Sandia National Labs., Albuquerque, NM (USA); RE/SPEC, Inc., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 18p. (CONF-850614—6; CONF-8509129—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015147.

From ASME-ASCE fluids engineering conference and joint mechanics conference; Albuquerque, NM, USA (24 Jun 1985).

Developments of geologic radioactive waste repositories require validated numerical models for use in predicting rock mass response to pre- and post closure conditions. This paper represents an initial effort in geomechanical model validations by comparing in situ-based measurements in welded tuff with predictions from a numerical model. Results from mechanical, thermomechanical, and shear loading measurements are compared with output from calculations made with a 2-D dynamic relaxation finite element code (SANCHO) that utilizes descriptive normal compliance and shear parameters for a jointed rock. Data from the NNWSI-sponsored heated block experiment in G-Tunnel at the Nevada Test Site are used for the comparisons. Analyses indicate that the jointed rock based continuum model can be used to calculate quantities consistent with the measured phenomena in jointed welded tuff for the simple boundary conditions evaluated. 9 refs., 5 figs., 3 tabs.

43877 (SAND—85-0507C) Slip-flow experiments in welded tuff: the Knudsen diffusion problem. Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850981—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017118.

From International symposium on coupled processes affecting the performance of a nuclear waste repository; Berkeley, CA, USA (18 Sep 1985).

Gas-phase permeability experiments, using nitrogen, were conducted on a sample of densely welded tuffaceous material from the Nevada Test Site. The primary independent variable was the average pore pressure, which was systematically varied from 13.1 to 0.1 MPa; net circumferential stress was maintained constant at 4.3 MPa. Gas permeability was found to be a strong function of pore pressure, undergoing an order-of-magnitude increase as pore pressure was reduced over the stated range. Based on these measurements, the Knudsen diffusion coefficient for water vapor, at 296 K, was calculated to be about 3.2×10^{-7} m²/s and the material's average pore diameter was estimated to be about 8×10^{-9} m. Comparison of this length scale with mercury intrusion porosimetry results showed agreement to within one order of magnitude. 8 refs., 3 figs.

43878 (SAND—85-0636C) Coupled hydrothermal flows of liquid and vapor in welded tuff: numerical modeling of proposed experiment. Eaton, R.R.; Bixler, N.E.; Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850981—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016456.

From International symposium on coupled processes affecting the performance of a nuclear waste repository; Berkeley, CA, USA (18 Sep 1985).

Pretest calculations of a proposed small-scale, heatpipe experiment have been made using a finite element, multiphase flow, computer code. The purpose of the experiment is to characterize the response of partially saturated, welded, volcanic tuff to the two-phase countercurrent flow induced by an applied temperature gradient. The experimental measurements will be used to refine the presumed permeability and capillary pressure functions, which are used in the finite element analysis. The calculations presented in this paper, using the presumed material functions, show that saturation profiles and experimental time scales are sensitive to applied temperature gradients and initial liquid saturations. The results have been used to predict appropriate experimental parameter ranges. 7 refs., 11 figs.

43879 (SAND—85-1146) Pretest reference calculation for the Heated Axisymmetric Pillar (WIPP Room H in situ experiment). Morgan, H.S.; Stone, C.M. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016805.

A pretest reference calculation for the Heated Axisymmetric Pillar or Room H experiment is presented in this report. The Heated Axisymmetric Pillar is one of several large scale in situ experiments currently under construction near Carlsbad, New Mexico, at the site of the Waste Isolation Pilot Plant (WIPP). This test is an intermediate step in validating numerical techniques for design and performance calculations for radioactive waste repositories in salt. The test consists of a cylindrically shaped pillar, centrally located in an annular drift, which is uniformly heated by blanket heaters. These heaters produce a thermal output of 135 W/m³. This load will be supplied for a period of three years. Room H is heavily instrumented for monitoring both temperature increases due to the thermal loading and deformations due to creep of the salt. Data from the experiment are not available at the present time, but the measurements for Room H will eventually be compared to the calculation presented in this report to assess and improve thermal and mechanical modeling capabilities for the WIPP. The thermal/structural model used in the calculation represents the state of the art at the present time. A large number of plots are included since an appropriate result is required for every Room H gauge location. 56 refs., 97 figs., 4 tabs.

43880 (SKBF-KBS-TR—83-50) Calculation of fluxes through a repository caused by a local well. Thunvik, R. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). May 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701866.

The purpose of the present study is to roughly estimate the ground water flux through a radioactive repository in relation to the flux into a local well under various conditions. The well is assumed to be located at a depth of either 60 or 200 metres below the ground surface. Two main settings are considered, in one the well is located in a vertical fracture zone at a distance of 100 metres from one of the outer edges of the repository. The withdrawal from the well is assumed to be 6 m³/day. The flow domain is characterized by a rather low permeability. The boundary conditions considered are either a continuously saturated upper boundary and impervious lateral boundaries, or a phreatic upper boundary and hydrostatic lateral boundaries. The ratio of the flux through the repository to the flux into the well was obtained to be in the range from about 10^{-5} to 10^{-3}, depending on the boundary conditions and the depth of the well. The lowest figures were obtained in the examples, in which the upper boundary was assumed to be continually saturated. It is concluded that these examples may be considered representative of the actual flow problem. This conclusion is based upon the fact that in the case of a phreatic boundary the drawdown caused by the well was very small and the flow responses were very slow, implying that rather a small infiltration rate is required to maintain saturated conditions at the upper boundary. The regional gradients caused by the well were rather small in comparison with the typically naturally occurring gradients. The flow to the well will therefore have little influence on the regional flow pattern in most practical cases.

43881 (USGS-OFR—85-363) Bibliography of reports by US Geological Survery personnel on studies of underground nuclear test sites and on waste management studies at the Nevada Test Site and the Waste Isolation Pilot Plant Site, New Mexico, January 1, 1983-December 31, 1984. Glanzman, V.M. (Geological Survey, Denver, CO (USA)). 1985. Contract AI08-76DP00474. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017123.

This bibliography lists reports by personnel of the US Geological Survey released to the public between January 1, 1983, and December 31, 1984. Reports include information on underground nuclear testing and waste management projects at the NTS (Nevada Test Site) (Figs. 1 and 2) and radioactive waste projects at the WIPP (Waste Isolation Pilot Plant) site, New Mexico (Fig. 3). The bibliography is divided into three categories: (1) reports regarding underground nuclear testing; (2) waste management projects at the NTS; and (3) waste management studies at the WIPP site. Reports are listed in each category by publication outlet. The USGS-474 series reports pertain to underground nuclear testing studies and are cross referenced to administrative (or in-house) series (for example, USGS-474-315 is cross referenced as NTS-264). The administrative series are used to break down the USGS-474 series for more specific area identification. A list of cross references is shown on page 6.

43882 (USGS-OFR—85-475) Geology of drill hole USW VH-2, and structure of Crater Flat, southwestern Nevada. Carr, W.J.; Parrish, L.D. (Geological Survey, Denver, CO (USA)). 1985. Contract AI08-78ET44802. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017235.

A 1219 meter (4000 ft) drill hole in Crater Flat shows the absence of buried Pliocene or Quaternary volcanic rocks, and penetrates a section of Timber Mountain, Paintbrush, and the upper part of the Crater Flat Tuffs, similar to that exposed adjacent to Crater Flat. A prominent negative aeromagnetic anomaly between the drill hole and Bare Mountain is attributed to a westward thickening section of a reversely magnetized Miocene basalt. The relatively shallow depth of this basalt in the west-central part of Crater Flat indicates that no large amount of tectonic movement has occurred in approximately the last 10 m.y. Massive brecciated wedges of Paleozoic rocks are penetrated in two stratigraphic intervals in the drill hole; the older one, between the Tiva Canyon Member of the Paintbrush Tuff and the Rainier Mesa Member of the Timber Mountain Tuff, correlates with the time of maximum faulting east of Crater Flat in the Yucca Mountain area. The younger slide masses are correlated with a large slide block of probable late Miocene age exposed along the southwestern rim of Crater Flat. The structural pattern and style buried beneath central and western Crater Flat is deduced to be similar to that exposed at Yucca Mountain, but less developed. The major fault system controlling the steep east face of Bare Mountain, though probably still active, is believed to have developed mainly as a result of caldera collapse between 13 and 14 m.y. ago. Relations between faulting and four episodes of basalt eruption in the Crater Flat area strongly suggest contemporaneity of the two processes. 17 refs., 2 figs., 3 tabs.

43883 (WIPP-DOE—220) Waste Isolation Pilot Plant. Project progress report for quarter ending June 30, 1985. (USDOE Albuquerque Operations Office, NM. Waste Isolation Pilot Plant Project Office). [1985]. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016919.

A progress report is given for site construction, design and engineering work, technical and institutional activities, and scientific and experimental studies.

43884 Perspective on demonstrating compliance with standards for disposal of high-level radioactive wastes. Kocher, D.C.; Smith, E.D.; O'Kelley, G.D.; Sjoreen, A.L. (Oak Ridge National Lab., TN (USA)). *Radioactive Waste Management and the Nuclear Fuel Cycle;* 6: No. 1, 1-18(Mar 1985).

A perspective which the authors have developed on the problem of demonstrating that geologic repositories for the disposal of high-level radioactive wastes will comply with system performance standards is discussed. Their viewpoint arises from a concern that the U.S. Environmental Protection Agency's proposed environmental standard for high-level waste disposal appears to require demonstrations of compliance which are incompatible with scientific knowledge; i.e., the standard does not take into account the likely importance of unquantifiable and unresolvable uncertainty in repository performance-assessment models. A general approach to demonstrations of compliance is proposed which is thought to be compatible with the kinds of technical information that will be available for judging long-term repository performance. The authors' approach emphasizes the importance of investigating alternative conceptual models and lines of reasoning in evaluating repository performance and the importance of subjective scientific judgment in the decision-making process.

43885 Testing and sampling of deep brine aquifers in the Palo Duro Basin, West Texas. Deyling, M.A. (Battelle Office of Nuclear Waste Isolation, Columbus, OH). *Ground Water Monitoring Review;* 4: No. 4, 147-151(Fal 1984).

The US Department of Energy is investigating the Palo Duro Basin of West Texas along with locations in Nevada, Washington, Utah, Mississippi and Louisiana as potential sites for storage of high-level nuclear waste. Ten wells have been drilled to depths between 3000 and 8300 feet. Testing and sampling of deep test zones requires advance planning and analysis of what must be obtained from the well. Various alternatives are available depending on data needs. In this particular instance, both hydrologic and geochemical data were required. The methods chosen were field proven methods used in the oil field industry for many years. Short term testing has included conventional oil-field-type drill stem tests and drill stem equipment with surface pressure readout. Long term testing has consisted of a series of production and recovery tests. Fluid sampling was performed in two stages. The first was at the well head under an imposed pressure of several hundred psi. The second fluid samples were collected downhole at the production zone under pressures close to ambient pressure. The geochemical data and hydrologic data can be used as independent checks on each other in many cases. Test results from the well along with examination of recovered core provided maximum data for each well. 5 references, 8 figures.

43886 Large-scale hydraulic conductivity measurements in fractured granite. Wilson, C.R.; Witherspoon, P.A.; Long, J.C.S.; Galbraith, R.M.; DuBois, A.O.; McPherson, M.J. (Creek Geotechnical Engineering, Berkeley, CA). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts;* 20: No. 6, 269-276(1983). Contract AC03-76SF00098.

The large-scale hydraulic conductivity experiment at Stripa, Sweden, was an attempt to produce a macromeasurement of the average hydraulic conductivity of approximately 200,000 m^3 of low-permeability fractured granite. Groundwater seepage into a 33 m long, 5 m dia drift was measured as the net moisture pickup of a ventilation system. Water pressures were monitored at 90 locations in the rock mass. The experiment was designed to treat the rock as a porous medium. Analysis of test results indicates a behavior approximating radial flow in a porous medium. Tests made at three different drift air temperatures yielded very similar results. Computations indicate that the average hydraulic conductivity of the monitored rock mass, exclusive of a zone of lower conductivity immediately surrounding the drift, is approximately 9.8×10^{-11} m/sec. 7 references, 8 figures.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 43856, 45144, 45180

43887 (ANL—85-11) Nuclear Technology Programs. Quarterly progress report, October-December 1984. Burris, L. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017075.

Studies of the ability of backfill to inhibit groundwater flow in a nuclear waste repository are reviewed. They involve permeability measurements, which are fundamental in determining whether the waste may be considered to remain isolated in the repository. Additional data on zeolite compositions have been obtained using new instrumentation and techniques for mineral separation. Tests using natural humic and fulvic acids taken from surface waters and added to groundwaters from wells in the Columbia River basalt show a strong correlation of americium complexation with acid concentrations in the groundwaters, but a weak correlation in the case of neptunium. A new effort to study the use of a TRUEX solvent extraction process for the Plutonium Finishing Plant waste stream is under way. The process is to remove plutonium and americium and then separate them. Destructive analyses of irradiated fuel rods continues. Work on several of the anticipated 16 or 17 rods has been accomplished.

43888 (DOE/OR/20722—58) Weldon Spring Site environmental monitoring report, calendar year 1984. (Bechtel National, Inc., San Francisco, CA (USA). Advanced Technology Div.). Jul 1985. Contract AC05-81OR20722. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017437.

During 1984, the environmental monitoring program was continued at the US Department of Energy (DOE) Weldon Spring Site (WSS), located in St. Charles County, Missouri. The WSS comprises two separate areas: a 52-acre Raffinate Pits (WSRP) area and a 9-acre Quarry (WSQ). The monitoring program measures the radon gas concentration in air, the radium and uranium concentrations in surface water and groundwater, and external gamma radiation levels at both sites. The nitrate and chloride content of surface water is also measured. All environmental samples collected are analyzed to determine compliance with applicable environmental quality standards. DOE Order 5480.1A, Chapter XI, provides applicable Concentration Guide (CG) limits for radionuclides in

controlled and uncontrolled areas. Potential radiation doses to the public from the radioactive materials stored at the site are also calculated. During 1984, site boundary radon concentrations, including naturally occurring sources, were all below the DOE CG limit of 3 pCi/1. Total uranium and radium-226 concentrations in groundwater within the controlled Raffinate Pit site were below the DOE CG limits for uncontrolled areas. At two on-site and two off-site locations in the Quarry area, total uranium content in groundwater exceeded the DOE CG limit for release to uncontrolled areas. Average external radiation exposure rates were not appreciably different from normal background for the area. All radiation doses to the public from the stored materials were within DOE standards.

43889 **(INIS-mf—9524) Decontamination of nuclear facilities. Keynote addresses.** (Canadian Nuclear Association, Toronto, Ontario; American Nuclear Society, La Grange Park, IL). 1982. 64p. (CONF-820973—Exc.). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781030.

From International conference on decontamination of nuclear facilities; Niagara Falls, Canada (19 Sep 1982).

Individual papers were indexed separately for the Energy Data Base.

43890 **(LBL—18587) Contact zones and hydrothermal systems as analogues to repository conditions.** Wollenberg, H.A.; Flexser, S. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 33p. (CONF-8410311—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016555.

From Workshop on radionuclide migration; Chicago, IL, USA (1 Oct 1984).

Radioactive waste isolation efforts in the US are currently focused on examining basalt, tuff, salt, and crystalline rock as candidate rock types to encompass waste repositories. As analogues to near-field conditions, the distributions of radio- and trace-elements have been examined across contacts between these rocks and dikes and stocks that have intruded them. The intensive study of the Stripa quartz monzonite has also offered the opportunity to observe the distribution of uranium and its daughters in groundwater and its relationship to U associated with fracture-filling and alteration minerals. Investigations of intrusive contact zones to date have included (1) a tertiary stock into Precambrian gneiss, (2) a stock into ash flow tuff, (3) a rhyodacite dike into Columbia River basalt, and (4) a kimberlite dike into salt. With respect to temperature and pressure, these contact zones may be considered "worst-case scenario" analogues. Results indicate that there has been no appreciable migration of radioelements from the more radioactive intrusives into the less radioactive country rocks, either in response to the intrusions or in the fracture-controlled hydrological systems that developed following emplacement. In many cases, the radioelements are locked up in accessory minerals, suggesting that artificial analogues to these would make ideal waste forms. Emphasis should now shift to examination of active hydrothermal systems, studying the distribution of key elements in water, fractures, and alteration minerals under pressure and temperature conditions most similar to those expected in the near-field environment of a repository. 14 refs.

43891 **(NLCO—2028) Feed Materials Production Center environmental monitoring annual report for 1984.** Facemire, C.F.; Jones, D.L.; Keys, R.W. (NLO, Inc., Cincinnati, OH (USA). Feed Materials Production Center). 15 Jul 1985. Contract AC05-76OR01156. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017323.

This report presents radioactivity data and associated analytical results. Plant discharges during the year were much less than established DOE/EPA guidelines. Consequently, offsite radiation exposures were only a small fraction of 1984 DOE/EPA guidelines for uncontrolled areas. However, these exposures, when compared to EPA NESHAP standards which were promulgated on February 6, 1985, were higher than recommended for the off-site maximally exposed individual, but significantly lower for all other cases considered. Recent organizational and mechanical changes should preclude any further accidental losses of uranium and other radionuclides back into the environment similar to those which occurred during the fall of 1984. It is expected that these changes will also allow full compliance with the NESHAP standards referenced above. Non-radioactive contaminants which are released during the normal operation of the facility were also monitored. The data and analyses shown in this report indicate that environmental concentrations of these contaminants were below established standards.

43892 **(SAND—85-0823C) Geochemical sensitivity analysis for performance assessment of HLW repositories: effects of speciation and matrix diffusion.** Siegel, M.D.; Erickson, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 24p. (CONF-8505180—3). NTIS, PC A02/MF A01 - GPO. File Number TI85016457.

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Performance assessment requires calculating radionuclide discharge for many sets of conditions and scenarios. In general, such calculations use empirical retardation factors that describe the average effect of all radionuclide/fluid/rock interactions. This method, however, may underestimate radionuclide discharges and disguise potential violations of regulatory standards. An alternative approach, coupled reaction-transport models, can be used to obtain a detailed understanding of physicochemical phenomena but the general application of such rigorous models may be impractical in repository performance assessment. The objective of this geochemical sensitivity analysis is to use simple, approximate models to calculate upper bounds for radionuclide discharges and to identify physicochemical conditions where more rigorous theoretical transport calculations must be done. An approximate model is given for bounding discharges of radionuclides in porous rock in scenarios where radioactive production is negligible but decay is appreciable, and several nuclides of an element migrate and undergo a speciation reaction. The model is incorporated into a methodology to determine critical combinations of hydrological and chemical parameter values that result in discharges that violate the HLW standard proposed by the US Environmental Protection Agency (40CFR 191). As an example, the methodology is applied to the discharges of ^{243}Am and ^{237}Np from a reference repository. It also is shown how results from the sensitivity analyses can be used to develop criteria for designing laboratory experiments so that effects of significant speciation reactions will be detected. Approximate methods for calculating radionuclide discharge are given for extending these analyses to transport in fractured rock where diffusion of radionuclides into the matrix may occur. 27 refs., 12 figs., 1 tab.

0540 Health And Safety

REFER ALSO TO CITATION(S) 43864, 43891

43893 (CONF-840806—Vol.1, pp 597-628) **Fire simulation in nuclear facilities--the FIRAC code and supporting experiments.** Burkett, M.W.; Martin, R.A.; Fenton, D.L.; Gunaji, M.V. (Los Alamos National Lab., NM). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The fire accident analysis computer code FIRAC was designed to estimate radioactive and nonradioactive source terms and predict fire-induced flows and thermal and material transport within the ventilation systems of nuclear fuel cycle facilities. FIRAC maintains its basic structure and features and has been expanded and modified to include the capabilities of the zone-type compartment fire model computer code FIRIN developed by Battelle Pacific Northwest Laboratory. The two codes have been coupled to provide an improved simulation of a fire-induced transient within a facility. The basic material transport capability of FIRAC has been retained and includes estimates of entrainment, convection, deposition, and filtration of material. The interrelated effects of filter plugging, heat transfer, gas dynamics, material transport, and fire and radioactive source terms also can be simulated. Also, a sample calculation has been performed to illustrate some of the capabilities of the code and how a typical facility is modeled with FIRAC. In addition to the analytical work being performed at Los Alamos, experiments are being conducted at the New Mexico State University to support the FIRAC computer code development and verification. This paper summarizes two areas of the experimental

work that support the material transport capabilities of the code: the plugging of high-efficiency particulate air (HEPA) filters by combustion aerosols and the transport and deposition of smoke in ventilation system ductwork.

43894 (CONF-840806—Vol.1, pp 732-751) **Predictions of local, regional and global radiation doses from iodine-129 for four different disposal methods and an all-nuclear future.** Wuschke, D.M.; Barnard, J.W.; O'Connor, P.A.; Johnson, J.R. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

The radioactive isotope ^{129}I produced by nuclear fission becomes globally distributed if released to the environment. The consequences of several options for management of ^{129}I are discussed. Estimates are presented of radiation doses from the ^{129}I produced in generating 1000 GW(e).a of nuclear electricity, the total production expected in Canada up to about 2040. Individual thyroid dose rates from ^{129}I, and accumulated collective effective dose equivalents to three groups are compared for four ^{129}I management strategies. These groups are: local persons living in the immediate vicinity of a discharge zone from a fuel reprocessing facility or waste disposal vault in the Canadian Shield, regional persons living in the lower Great Lakes basin, and average global persons. The four management strategies studied were: atmospheric discharge from a reprocessing facility, ocean dumping, subseabed disposal, and isolation in a deep vault in plutonic rock in the Canadian Shield. Doses associated with each of these options are compared with each other and with proposed Canadian regulatory limits. Estimates are also presented of doses to the same groups from fission-product ^{129}I, if fission supplied all future world energy needs. The two management options considered were geological disposal in vaults that would each eventually discharge ^{129}I at the rate estimated for a disposal vault in the Canadian Shield, and ocean dumping. Again, doses arising from these options are compared with each other and with proposed regulatory limits. The second comparison allows estimates to be made of the time at which such intensive use of fission could produce unacceptable levels of ^{129}I in the environment.

43895 (DPS—84-03-SEAPS) **Method for the evaluation of radiologic consequence of the dumping of low- and medium-level radioactive wastes on the deep sea bed.** Calmet, D.; Charmasson, S.; Dumas, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Mar 1984. 31p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751209.

The method presented is based on the study of the different ways for immersed radionuclides to reach man. These transfers are decomposed in events describing fundamental processes arising in the physical, chemical or biological chain. The modelization of the two first transfer steps: radionuclide leaching from the corroded containers and dilution of radionuclides in Atlantic Ocean is more particularly developed.

43896 (RRC—55, pp 47-53) **UK National Arrangements for Incidents Involving Radioactivity (NAIR).** Lister, B.A.J. (United Kingdom Atomic Energy Research Establishment, Harwell, Great Britain). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A description of the activities of the activities and responsibilities of the National Radiological Protection Board of the United Kingdom is provided. It is a co-ordinated service which is simple to put into operation. If there were a major accident it could help the country's resources to be quickly pooled. Moreover, because of the wide geographical distribution of the sources of help, assistance can be obtained more quickly than if reliance were placed on only a few establishments. 1 tab. (DT)

43897 (RRC—55, pp 54-58) **Interagency Radiological Assistance Plan (US DOE).** Horan, J.R. (International Atomic Energy Agency, Vienna, Austria). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The US Atomic Energy Commission, realizing that increased use of radioactive materials increased the probability of accidents involving these materials, developed its Radiological Assistance Plan (RAP) in 1958. This plan, through governmental reorganizations, is now under the direction of the Department of Energy (USDOE). Personnel, equipment and services can be obtained 24 hours a day by any individual or any agency through any of DOE's field offices. Depending upon the magnitude of the assistance required, resources of thirteen federal agencies can be obtained by DOE through the activation of the Interagency Radiological Assistance Plan (IRAP) which DOE coordinates. 1 fig. (DT)

43898 (RRC—55, pp 59-62) **Radiation emergency preparedness in Thailand.** Pongpat, P. (Office of Atomic Energy for Peace, Bangkhen, Bangkok, Thailand). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

In Thailand, the Office of Atomic Energy for Peace (OAEP) has been responsible for regulating the peaceful uses of radioisotopes, radiation safety and protection, waste disposal and management, since 1962. A radiation safety manual (Thai.AEC-1) was re-issued in 1963 and revised (Thai.AEC-1/Rev.1) in 1968. This manual contains the rules and procedures relating to radiation safety that are to be followed in all Thai AEC operations. The procedures have to be followed in the event of an emergency of any type so that a rapid and smooth control of the situation is achieved not only within the site but also in any area of the environment which may be affected. 3 refs., 1 fig. (DT)

43899 (RRC—55, pp 89-95) **Radiation accidents in industrial and medical applications of radiation sources, preparedness and management.** Subrahmanian, G.; Shah, V.R.; Subbaratnam, T.S.; Gangadharan, P. (Bhabha Atomic Research Centre, Bombay, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

In India, it is obligatory on the part of the users of radioisotopes to inform the Division of Radiological Protection, Bhabha Atomic Research Centre, in case of any unusual occurrences with radiation sources. This Division attends to such emergencies and takes all possible measures to minimize the radiation exposure to the people concerned and also to the public at large. Some of these incidents and the experiences gained therein are summarized here. 2 tabs. (DT)

0550 Regulations

REFER ALSO TO CITATION(S) 43862, 44751, 45175, 45930

43900 (AECL—7902) **Design and performance evaluation of the ultrasonic random coil identity-integrity element for underwater safeguards seals.** Allen, V.H.; Backer, S.; Smith, M.T. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702038.

Irradiated fuel discharged from CANDU power reactors is stored underwater and, in order to comply with the requirements of International Safe-guards, the fuel is stacked in sealed containers which are examined at intervals by IAEA inspectors. The seals are verified for identity and integrity and this report describes the design of an identity/integrity element for the seals. The element is in the form of a random coil of wire which is interrogated by ultra-

sonic methods. An evaluation of thirty-six seals is reported. The application of seals to stacks of fuel was simulated in a water-filled bay at CRNL and repetitive verification measurements were made which simulated inspection procedures. The seal identity signatures were compared using cross-correlation methods and the results show that a broken or tampered seal can be identified with a high level of confidence.

43901 **(DP-MS—83-50) Experience with confirmatory measurements at the Savannah River Plant.** Deason, P.T.; Cadieux, J.R.; Denard, C.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1985. Contract AC09-76SR00001. 8p. (CONF-850765—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016568.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

Confirmatory measurements are performed on all category I and II plutonium shipments to the Savannah River Plant (SRP). The primary technique employed has been neutron coincidence counting using three instruments; two slab counters, and a well counter. These measurements have provided the required safeguards features to support the physical security measures already in place for inter-site shipments of special nuclear material (SNM). Similar confirmatory measurements have also been performed on a variety of scrap mixed-oxide materials stored at SRP for later processing. The data handling and results for several categories of material will be examined in addition to planned uses of the Rocky Flats Plant (RFP)/SRP Confirmatory Measurements Counter (CMC). 2 refs., 4 figs.

43902 **(K/OA—5929) Application of the limited frequency-unannounced access strategy measurement technology in gas centrifuge enrichment plants.** Swindle, D.W. Jr. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jul 1985. Contract AC05-84OT21400. 9p. (CONF-850765—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015802.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

As part of a limited frequency-unannounced access inspection strategy for international safeguards, a gamma ray measurement technique for confirming the absence of highly enriched uranium inside gas centrifuge enrichment plant cascade header pipes has been developed by the US Enrichment Safeguards Program, and equipment for application of this measurement technique by an international safeguards inspector has been designed. This pipe measurement strategy is based on a two-phase measurement approach that is capable of verifying whether the enrichment of the UF_6 gas currently in a pipe exceeds 20% U-235 and whether UF_6 gas exceeding 20% U-235 has been in a pipe within the last 24 h. An automated measurement process sequence has been incorporated into the firmware of a portable multichannel analyzer to lead an international safeguards inspector through the measurement sequence, and implementation and inspection procedures have been developed. Described are the verification technique, the detection equipment, and the automated decision process that have been developed by US Enrichment Safeguards Program participants at Los Alamos National Laboratory and Martin Marietta Energy Systems, Inc., Oak Ridge Gaseous Diffusion Plant. Also noted are measurement technology developments from other countries that were useful in developing the US Enrichment Safeguards Program's gamma ray measurement technique. Results from an initial International Atomic Energy Agency session for evaluation of the verification technique, the detection equipment, and the procedures for their use are summarized. 7 refs., 5 figs.

43903 **(LA-UR—85-2398) Special nuclear material radiation monitors for the 1980's.** Fehlau, P.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850765—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015667.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

During the two decades that automatic gamma-radiation monitors have been applied to detecting special nuclear material (SNM), little attention has been devoted to how well the monitors perform in plant environments. Visits to 11 DOE facilities revealed poor information flow between developers, manufacturers, and maintainers of SNM radiation monitors. To help users achieve best performance from their monitors or select new ones, Los Alamos National Laboratory developed a hand-held monitor user's guide, calibration manuals for some commercial SNM pedestrian monitors, and an application guide for SNM pedestrian monitors. In addition, Los Alamos evaluated new commercial SNM monitors, considered whether to apply neutron detection to SNM monitoring, and investigated the problem of operating gamma-ray SNM monitors in variable plutonium gamma-radiation fields. As a result, the performance of existing SNM monitors will improve and alternative monitoring methods will become commerciallly available during the 1980s. 9 refs., 6 figs., 1 tab.

43904 **(LA-UR—85-2417) Safeguards uses of confirmatory measurements.** Coulter, C.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-850765—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015722.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

An analysis is made of the role of shipper and receiver measurements in safeguarding special nuclear materials (SNM) transferred from one facility to another, with emphasis on the case where the receiver requires an analytical accounting measurement of the transferred SNM and does not need the material for process purposes at the time of receipt. Seven possible diversion periods are considered, ranging from the interval between the shipper's final accounting measurement on the material and the time it is placed in the shipper's vault, through the actual transport of the material between facilities, to the time the material is removed from the receiver's vault and placed in the process. The detection power of various combinations of six possible shipper/receiver measurements for these diversion opportunities is then evaluated; the measurements considered include the shipper's and receiver's accounting measurements, the latter at two possible times, and various nondestructive assay (NDA) confirmatory measurements. It is concluded that all safeguards measurement objectives can be met by a combination of a shipper's accounting measurement at the time the material is removed from the process, an appropriate shipper's NDA confirmatory measurement either immediately after canning or immediately before shipping, an equivalent receiver's NDA confirmatory measurement immediately after the material is received, and a receiver's accounting measurement when the material is placed in the process. Furthermore, it is found that a receiver's analytical accounting measurement immediately after receipt when the material is not yet required for process has dubious safeguards value.

43905 **(LA-UR—85-2566) Extrinsic and intrinsic complexities of the Los Alamos Plutonium Processing Facility.** Bearse, R.C.; Longmire, V.L.; Roberts, N.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850765—18). NTIS, PC A02. File Number DE85015692.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

Analysis of the data obtained in one year of plutonium accounting at Los Alamos reveals significant complexity. Much of this complexity arises from the complexity of the processes themselves. Additional complexity is induced by errors in the data entry process. It is important to note that there is no evidence that this complexity is adversely affecting the accounting in the plant. We have been analyzing transaction data from fiscal year 1983 processing. This study involved 62,595 transactions. The data have been analyzed using the relational database program INGRES on a VAX 11/780 computer. This software allows easy manipulation of the original data and subsets drawn from it. We have been attempting for several years to understand the global features of the TA-55 accounting data. This project has underscored several of the system's complexities. Examples that will be reported here include audit trails, lot-name multiplicity, etc.

43908 **(LA-UR—85-2567) Confirmatory measurements of UF_6 using the neutron self-interrogation method.** Stewart, J.E.; Ensslin, N.; Menlove, H.O.; Cowder, L.R.; Polk, P.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850765—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015752.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

A passive neutron counting method has been developed for measurement of the ^{235}U mass in Model 5A cylinders of UF_6. The unique neutronic properties of UF_6 containing highly enriched uranium (HEU) permit ^{235}U assay using only passive neutron counting. The sample effectively assays itself by self-interrogation. Shipped from enrichment plants and received at fuel fabrication and conversion facilities, 5A UF_6 cylinders hold up to ~17 kg of ^{235}U each. Field measurements at the Portsmouth Gaseous Diffusion Plant (GDP) showed an average assay accuracy of 6.8% (1σ) for 44 cylinders with enrichments from 6 to 98% and with a range of fill heights. Further measurements on 38 cylinders containing 97%-enriched material yielded an accuracy of 2.8% (1σ). Typical counting times for these measurements were less than 5 min. An in-plant instrument for receipts confirmation measurements of 5A UF_6 cylinders has been developed for the Savannah River Plant. The Receipts Assay Monitor (RAM) is currently being tested and calibrated. It is designed to confirm declared fissile mass in all incoming 5A cylinders containing HEU in the form of UF_6. One of the computer-controlled features is a removable cadmium liner for the sample cavity. The liner allows a sample fill-height correction, which significantly improves assay accuracy.

43907 **(LA-UR—85-2736) Measurement of the enrichment of uranium in the pipework of a gas centrifuge enrichment plant.** Packer, T.W.; Lees, E.W.; Close, D.; Nixon, K.V.; Pratt, J.C.; Strittmatter, R. (Los Alamos National Lab., NM (USA); UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). 1985. Contract W-7405-ENG-36. 8p. (CONF-850765—19). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015730.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

The US and UK have been separately working on the development of a NDA instrument to determine the enrichment of gaseous UF_6 at low pressures in cascade header pipework in line with the conclusions of the Hexapartite Safeguards Project viz. the instrument is capable of making a "go/no go" decision of whether the enrichment is less than/greater than 20%. Recently, there has been a series of very useful technical exchanges of ideas and information between the two countries. This has led to a technical formulation for such an instrumentation based on γ-ray spectrometry which, although plant-specific in certain features, nevertheless is based on the same physical principles. Experimental results from commercially operating enrichment plants are very encouraging and indicate that a complete measurement including set up time on the pipe should be attainable in about 30 minutes when measuring pipes of diameter around 110 mm. 5 refs., 4 figs.

43906 **(NUREG/CR—4107) Sequential test procedures for detecting protracted materials losses.** Goldman, A.S. (Los Alamos National Lab., NM (USA)). Jul 1985. Contract W-7405-ENG-36. 49p. (LA—10319-MS). NTIS, PC A03/MF A01 - GPO. File Number TI85016543.

Sequential tests are required for detecting protracted (trickle) losses of strategic special nuclear materials from a single materials control unit (MCU). We compared applicable tests including modified versions of Page's test and power-one procedures. We used simulated data from a MCU in a conversion/fabrication process that took into account process variations, materials holdup, and measurement uncertainties. Comparisons were made over a 60-day accounting period under different loss scenarios. Some important findings include: (1) no single test procedure is best for all diversion scenarios; (2) power-one procedures are best for protracted losses that occur early in the accounting period and Page's test is best for late loss occurrence; (3) if holdup and process variations are not included in the Inventory Difference model but are present in the process, then assuming steady-state conditions, false-alarm probabilities can double. 19 refs., 16 figs., 3 tabs.

43909 **(SAND—85-0022) Integrated Monitoring System II (IMS-II). User's manual.** Gallegos, M.H. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017386.

The IMS-II was designed to monitor up to four unattended areas containing assets of safeguards interest through the use of video equipment and motion detectors. One module of the system equipment is the Inspector Display Module (IDM), which interacts with the Data Collection Module (DCM) to initialize the system and retrieve data from the DCM. This document is intended to guide an inspector through the various functions of the IDM for the purpose of initializing and retrieving information once the system is operational. 5 figs.

43910 **(SAND—85-1635C) Status of personnel identity verifiers.** Maxwell, R.L. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 8p. (CONF-850765—28). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017115.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

Identity verification devices based on the interrogation of six different human biometric features or actions now exist and in general have been in development for about ten years. The capability of these devices to meet the cost and operational requirements of speed, accuracy, ease of use and reliability has generally increased although the verifier industry is still immature. Sandia Laboratories makes a continuing effort to stay abreast of identity verifier developments and to assess the capabilities and improvements of each device. Operating environment and procedures more typical of field use can often reveal performance results substantially different from laboratory tests. An evaluation of several recently available verifiers is herein reported.

43911 **(SAND—85-1790C) Positive identity entry control system with geographically distributed portals and enrollment stations.** McIntire, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850885—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016167.

From 1. annual AFCEA symposium and exposition on physical and electronic security; Philadelphia, PA, USA (19 Aug 1985).

A positive identity entry control system using distributed processing to allow reliable geographically separated portals and enrollment stations has been installed and is fully operational at a large area DOE site. Identity verification requires a credential, a memorized number and measurement of a physical characteristic of the user. Additionally, all portal activity is monitored by guards. The portal system is dual redundant such that no single point failure will shut down operations. Each portal site maintains its own subset of the master data base so off-site failure of the central data base manager or its communication links will not significantly affect local portal activity. The system is suitable for installations with large populations requiring access control at several remote sites scattered over a large area. 2 figs.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

43912 **(PNL—5492) List of DOE radioisotope customers with summary of radioisotope shipments, FY 1984.** Baker, D.A. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016978.

This edition of the radioisotope customer list was prepared at the request of the Office of Health and Environmental Research (ER-73), Office of Energy Research, Department of Energy (DOE). This document describes radioisotope distribution from DOE facilities to private firms including foreign and other DOE facilities. The information is divided into five sections: (1) isotope suppliers, facility contacts, and isotopes or services supplied; (2) customers, suppliers, and isotopes purchased; (3) isotopes purchased cross-referenced with customer numbers; (4) geographic locations

of radioisotope customers; and (5) radioisotope sales and transfers - FY 1984.

0701 Physical Isotope Separation

43913 **(AECL—7915) Isotope enrichment in zirconium with a plasma centrifuge. Final report on contract CR31-3946.** Schmeing, H.; Buyers, W.J.L.; Dolling, G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1983. 13p. (PASS—20-5-R). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701941.

This report presents a summary of the work done by Omega-P, Inc., at the Yale University plasma centrifuge under AECL contract CR31-3946. The goal of the contract was to establish the feasibility of large scale production of isotopically enriched zirconium by this novel technique. Scientific, technical and costing aspects were to be considered. Largely as a result of this contract, the scientific and technical feasibility of centrifugal isotope separation in rotating plasmas on a commercial scale is now established. Cost advantages are likely to be realized for many isotopes. For zirconium a huge price advantage over the calutron type enrichment is indicated, although not quite as much as is required for AECL's needs. In spite of favourable results it is recommended that AECL not divert any substantial effort into developing a plasma centrifuge facility until a case can be made based on small scale production of specific medical isotopes.

43914 **(INFO—0102-1) Probabilistic consequence assessment of hydrogen sulphide releases from a heavy water plant. Scope determination.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Monserco Ltd., Mississauga, Ontario (Canada)). 20 Jan 1983. 121p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701972.

This report is concerned with the evaluation of the consequences to the public of an accidental release of hydrogen sulphide (H_2S) to the atmosphere following a pipe or pressure envelope failure, or some other process upset, at a heavy water plant. It covers the first stage of a programme in which the nature of the problem was analyzed and recommendations made for the implementation of a computer model. The concepts of risk assessment and consequence assessment are discussed and a methodology proposed for combining the various elements of the problem into an overall consequence model. These elements are identified as the 'Initiating Events', 'Route to Receptor' and 'Receptor Response' and each is studied in detail in the report. Such phenomena as the blowdown of H_2S from a rupture, the initial gas cloud behaviour, atmospheric dispersion and the toxicity of H_2S and sulphur dioxide (SO_2) are addressed. Critical factors are identified and modelling requirements specified, with special reference to the Bruce heavy water plant. Finally, an overall model is recommended for implementation at the next stage of the programme, together with detailed terms of reference for the remaining work.

43915 **(INFO—0102-2) Probabilistic consequence assessment of hydrogen sulphide releases from a heavy water plant. GASPROB code documentation.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Monserco Ltd., Mississauga, Ontario (Canada)). Jun 1983. 213p. NTIS (US Sales Only), PC A10/MF A01. File Number DE85701973.

In ASCII FORTRAN on VAX 11/750.

This report is the second in a series concerned with the evaluation of the consequences to the public of an accidental release of hydrogen sulphide (H_2S) to the atmosphere following a pipe or pressure envelope failure, or some other process upset, at a heavy water plant. It consists of documentation of the code GASPROB, which has been developed to provide consequence probabilities for a range of postulated releases. The code includes mathematical simulations of initial gas behaviour upon release to the atmosphere, such as gravitational settling of a cold release and the rise of jets and flares, subsequent atmospheric dispersion under a range of weather conditions, and the toxic effects on the exposed population. The code makes use of the site-specific dispersion climatology, topography and population distribution, as well as the probabilistic lethal dose data for the released gas. Output for a given postulated release can be provided in terms of the concentration of the gas at ground level around the point of release, projected numbers of fatalities within specified areas and the projected total fatalities regardless of location. This report includes a general description of GASPROB, and specifics of the code structure, the function of each subroutine, input and output data, and the permanent data files established. Three appendices to the report contain a complete code listing, detailed subroutine descriptions and a sample output.

43916 **(INFO—0102-3) Probabilistic consequence assessment of hydrogen sulphide releases from a heavy water plant. Consequence assessments.** Baynes, C.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 26 Mar 1984. 125p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701974.

This report provides the results of a programme to evaluate the risks to the public of accidental releases of hydrogen sulphide (H_2S) gas from a heavy water plant. The present programme gives the risks in quantitative terms, assuming the given postulated accident occurs. This is termed a consequence assessment and, in this study, is expressed in probabilistic terms, i.e. a probability distribution of the number of fatalities is given for each postulated accident. The consequence assessments were performed using a computer code, GASPROB, which has been developed specifically for this purpose. The code simulates initial gas behaviour upon release to the atmosphere, subsequent atmospheric dispersion under a range of possible weather conditions, and the toxic effects on the exposed population. The code uses site-specific meteorological, topographic and population data, and lethal dose curves for the released gas, whether H_2S or sulphur dioxide (SO_2). In the present study, site specific data for the Bruce heavy water plant have been used. The major topic of this report is the derivation of probabilistic consequences for some forty-three postulated accident scenarios at Bruce, ranging from a break in a 50 mm (2 inch) H_2S vapour line to the catastrophic failure of a 180 tonne storage tank of liquid H_2S.

0702 Radiation Sources

43917 **(DOE/CH/10211—4) Use of gamma radiation as a form of preservation of sweet potatoes. Quarterly progress report.** Loretan, P.A.; Tolbert, M.E.M. (Tuskegee Inst., AL (USA). Carver Research Foundation). 1985. Contract FG02-84CH10211. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016723.

Reported are: harvesting, sweet potato analysis, entomology, sensory evaluation, food science analysis, and enzyme study in sweet potatoes. (DLC)

43918 **(DP-MS—85-25) Irradiator design with large-volume source cylinders.** Eichholz, G.G.; Craft, T.F.; Suh, D.Y. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering and Health Physics). 1985. Contract AC09-76SR00001. 68p. (CONF-850610—45). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016569.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

To provide for economic utilization of prospective vitrified cesium-137 waste elements, a study was conducted for a conceptual irradiator system based on these elements for the commercial sterilization of sewage sludge for land spreading as fertilizer. A literature study showed that dried sludge could be sterilized more efficiently than wet. Adequate destruction of E. coli in sludge could be obtained with radiation doses as low as 150 kR. However, a dose of about 1 megarad is generally regarded as mandatory. Two cesium waste concentrations had been proposed. The one incorporating lower concentrations of Cs-137 and a surface dose of 20 kR/h was insufficiently active. Work, therefore, concentrated on the more active source cylinders, which are 18 cm in diameter with a specific activity of 16 to 17 Ci/cc. The conceptual design envisages the dry sludge passing horizontally by a conveyor system, past two rows of source elements in a three-pass array. A computer program has been developed to produce isodose contours and to calculate integrated doses for various source-target configurations.

43919 **(PNL-SA—12852) Fission product cesium-137 as a source for irradiators.** Tingey, G.L. (Pacific Northwest Labs., Richland, WA (USA)). Jan 1985. Contract AC06-76RL01830. 6p. (CONF-850610—33). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016276.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

As demand for irradiator sources grows, fission product ^{137}Cs could play a role in meeting this demand. Presently encapsulated ^{137}Cs is in very limited supply and can make only minor contributions to the immediate demand. However, other sources of ^{137}Cs are being evaluated from defense waste, and major quantities will not be available unless processing of power reactor fuels is reinstituted.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 43936, 44825, 44827, 44828

43920 **(BMFT-FB-T—85-060) Production of hydrogen for hydrogenation of heavy oil and coal.** Pontow, B.; Wenning, H.P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1985. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752670.

The project target was the construction and plant tests of gasification of hydrogenation residues for generation of hydrogen as feed for hydrogenation plants. The process serves for economical exploitation of hydrogenation residues with low impact to the environment simultaneously providing hydrogen necessary for hydrogenation. The feeding of hydrogenation residues into high pressure gasifiers can be achieved on two different routes. For the first the hot, liquid hydrogenation residue can be fed by means of suspension pumps. On another second route the solidified hydrogenation residue pyrolysis coke - is carried over to the high pressure gasifier by means of an extruder. Both routes were tested within the project. The hydrogenation residue could be converted to synthesis gas with 98.5% conversion. The extruder feeding system showed safe and reliable operation. The conveyed solid together with an added wetting agent forms a gas-tight plug. Simultaneously conveyance of the feedstock is achieved with a constant feed rate. Furthermore the behaviour of the gasification residue of high ash-containing feedstocks like hydrogenation residue was investigated. The waste water showed only small heavy metal concentrations. The project results serve as basis for planning a demonstration plant of residues and coal gasification.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 43923

43921 (CONF-801197—, pp 29-34) **Charcoal gasification.** Bliss, W. (Yell County Farm Bureau, Bluffton, AR). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Described is a stationary charcoal gasification system to run a 60-horsepower engine for a sawmill. The engine formerly used seven gallons of gasoline per hour, but now uses 12 pounds of charcoal per hour. The system has run the sawmill several hundred hours with very good results.

43922 (CONF-801197—, pp 150-160) **Methane digesters and cogeneration.** Martin, J. (Schaffer and Roland Inc.). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

An anaerobic digester is described that ferments livestock manure and generates methane. The methane is burned to generate eletrical energy. Alcohol production systems are being adapted so that they can take advantage of the waste heat from the engine-generator set to convert the low-grade waste heat into high-grade alcohol fuel.

43923 (CONF-801197—, pp 173-184) **Vegetable oil for diesels.** Peters, J.F.; Ziemke, M.C. (Univ. of Alabama, Huntsville). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Recent reports of successful short-term use of the common plant oils such as soybean and sunflower seed oil in farm diesel engines have caused considerable interest in the technical feasibility and economics of this practice. A feasibility study of plant oil refining requirements is being conducted. This study concentrates on the economics of refining crude soybean oil which can safely be used as a substitute for 2D diesel fuel. Initial indications are that there are no major barriers to this refining goal although minimum refining plus at least 50% dilution with regular 2D fuel will almost certainly be the most cost-effective practice. The authors have also investigated the economics of plant oil fuels versus petroleum-based fuels for diesel engines. Even if the supply of Mideast crude oil remains at normal levels for most of the next three years, plant oil based fuels will be cost-competitive by that time. Given the promising technical and financial outlook for these biomass fuels, a plan to use them to replace 35% of US 2D diesel fuel requirements by 1990 is presented. The heart of this plan is a 100% average increase in feedstocks (primarily soybeans) and a 300% increase in plant oil extraction and refining facilities. It is believed that the plant oil industry will build these facilities if US farmers can supply the necessary crops. If this goal is accomplished, the US balance of trade will improve by at least 14 billion dollars per year. 14 tabs.

43924 **(DOE/ET/14914—1) Conversion of methanol to gasoline. Operation of the demonstration plant. Milestone report.** Edwards, M.; Gierlich, H.; Gould, R.; Thiagarajan, N. (Union Rheinische Braunkohlen Kraftstoff A.G., Wesseling/Koeln (Germany, F.R.)). Aug 1985. Contract FC01-80ET14914. 130p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017046.

The 100 BPD fluid-bed methanol to gasoline (MTG) demonstration plant operation has exceeded the original process objectives. Specifically, the results show: stable unit operation is achieved with excellent gas/catalyst mixing resulting in complete methanol conversion; bed temperature control is readily accomplished, although the process is highly exothermic; catalyst attrition is low, which confirms the mechanical strength of the catalyst - the small make-up used for activity control at normal conditions exceeds the low attrition rate; process parameters can be varied to obtain the desired gasoline yield and quality; and engineering design parameters have been confirmed at the pilot plant stage and a scale-up to a commercial-size MTG fluid-bed system is now deemed feasible. The results obtained gave a broad basis for the conceptual design of a coal-based commercial-size plant for the production of MTG gasoline. This study is presently in preparation and will be completed by the middle of 1985. The conceptual design will be based on a 2500 tonnes/day methanol plant feeding a single MTG fluid-bed reactor. Six trains will be used for a maximum plant capacity of 15,000 tonnes/day. 43 figs., 26 tabs.

43925 (DOE/METC—84-34, pp 255-265) **Engineering assessment of thermal gasification systems for municipal solid wastes.** Tuck, J.K. Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

In recent years a number of pilot and demonstration gasifiers have been constructed for municipal solid waste conversion. These gasifiers have produced mixed results in terms of performance and cost. In many cases the quality and yield of gas, oil and char products have not been as expected and economic viability has been difficult to demonstrate. In particular gasification of municipal solid

wastes in reactors where direct heat is applied by partial combustion has not been successfully demonstrated at a commercial level. Slagging of glass, channeling of the gas flow and high particulate loadings in the fuel gas have been persistent problems. Pyrolysis of municipal wastes appears to be viable even though numerous technological and economic uncertainties exist. The successful implementation of pyrolysis technology is dependent on resolution of these uncertainties by continued research and demonstration. 16 references.

43926 (DOE/METC—84-34, pp 301-307) **Animal faeces can be recycled as useful synthetic oils.** Edewor, J.O.; Anagno, G. (Univ. of Lagos, Akoka-Lagos, Nigeria). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

It is already a known fact that cellulosic wastes can be recycled to produce synthetic oils. Infra-red analyses revealed that functional groups similarities occur between cellulosic materials and cow-dung and donkey dung. Logically, one would conclude that these dungs can also be hydrogenated to give synthetic oils. Reactions carried out on them reveal that cow dung could yield oils (of bituminous type) to a level of 20%, gaseous by-products of 15% and residual char of 50-65%. All these percentages are based on dry weight of original dung. Similarly, donkey dung gave figures of 25%, 15% and about 60% respectively. Operation parameters used for converting these dungs to oils showed that less drastic temperatures and pressures were required, compared to those needed for cellulose-based processes. Typical data are 295°C and 30 - 95 atmospheres. Analysis of product oil showed that about 95% of it was of the bituminous type with carbon-hydrogen ratio of about one. Economic considerations indicated that the costs of production of bitumens from these dungs will be less than those for cellulosic wastes. 5 references, 8 tables.

43927 (DOE/METC—84-34, pp 477-490) **Anaerobic digestion of sugar cane wastes.** Dasgupta, A.; Nemerow, N.L. (Weston Designers-Consultants, West Chester, PA). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

The cane sugar manufacturing industry generates large quantities of ligno-cellulosic solid wastes, namely bagasse and cachaza. Bagasse is the fibrous residue of the cane after extraction of the juice. Cachaza is the filter cake of the lime-precipitated insoluble sugars. Bench-scale investigations were conducted to determine the feasibility of anaerobic digestion of a mixture of bagasse and cachaza to produce methane. Two ratios of bagasse-cachaza mixture were investigated as substrates for anaerobic digestion. The first bagasse-cachaza ratio studied was 8:1, which represents a typical ratio of bagasse and cachaza wastes produced in a raw sugar mill. The second ratio investigated was 2.4:1, which represents the approximate ratio following the normal procedure of burning 70% of the bagasse generated in sugar mill boilers. The success of the preliminary batch studies formed the basis of the current investigations on the bagasse-cachaza substrate using completely mixed anaerobic digesters operated on a continuous mode. 10 references, 5 tables.

43928 (DOE/R2/05304—T1) **[Biomass digestion for family farms]. Final progress report.** Whitlock, D.; Flynn, J. (Flynn (Joseph), Bliss, NY (USA)). 14 Feb 1984. Contract FG42-81R205304. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015644.

The purpose of the project was to design, construct, and operate a methane digester on a farm in Bliss, New York. Highlights of accomplishments during the lifetime of the project are summarized. Gas production has been maintained at 2500 cu ft/day. This gas has been used to heat water for the house and for space heating in the barn and house. The daily savings on electricity was about $17.00 per day.

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43929 (EUR—9748-FR) **Biomass gasification project AVSA.** Masson, H.A. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 84p. (In French). Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A simplified design has been proposed for a small scale fluid bed combustor-gasifier system. Bench scale cold tests facilities have been used to optimise the operating parameters by a thermal tracing technique. Circulating rates as high as 1000 kg/s m^2 have been achieved. The selected fuel consists of biomass pellets. Their combustion rate and segregation tendencies have been determined in small scale units. Thermogravimetry and thermal differential analyses have been used in an air and in a N_2-CO_2 atmosphere to define the heat of the main reactions and the temperatures at which they take place. Steam gasification has been studied in a micropilot heated fluid bed. It produces a gas containing about 40% H_2. A pilot unit (200 kg/h) has been constructed and the combustion cell has been operated successfully. Combustion efficiencies as high as 97.8% were obtained, while the thermal efficiency ranges around 83%.

43930 (PB—85-195477/XAB) **Development of biogas in Nepal: an analysis of the past and direction for the future.** Lau-Wong, M.M. (Development and Consulting Services, Butwal (Nepal)). 1985. 12p. NTIS, PC A02/MF A01.

This report covers various aspects of the development of biogas in Nepal including: the technology; the mode of extension; the market; the economics; and directions for future work. Future directions considered are community ownership, biogas for income generation and irrigation, research for suitable feedstock for gas plants, and price reduction.

43931 (PB—85-200251/XAB) **Techno-economic assessment of direct biomass liquefaction processes. Research report.** McKeough, P.; Nissilae, M.; Solantausta, Y.; Beckman, D.; Oestman, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1985. 142p. NTIS, PC E07/MF E01.

Processes being developed for the direct liquefaction of biomass were reviewed and six of them were selected for detailed assessment. These included both high-pressure and pyrolysis processes, employing both wood and peat as feedstocks. In the assessment, special attention was given to the technical uncertainties involved in the design of the processes. Production costs of primary liquids were calculated and the processes compared. Costs for upgrading two of the primary products into gasoline were also estimated. A high overall thermal efficiency to liquid products (of the order of 60%) can be obtained by both high-pressure and pyrolysis processes. On the basis of the estimated upgrading costs, it was not possible to decide which of the processes - Flash pyrolysis/wood or PERC/wood - is more promising for the production of transport fuels. The PERC process is the most technically certain of those studied. For all the processes, however, much more data has to be generated if the reliability of the process designs is to be significantly improved. Further research and development is especially required in the following areas: upgrading of primary products; feed preparation; optimization of reaction conditions and gas utilization (high-pressure processes); design of reactors (pyrolysis processes) and determination of the heat transfer properties of feed slurries (high-pressure processes).

43932 (PB—85-220622/XAB) **Limits of thermochemical and photochemical syntheses of gaseous fuels: a finite-time thermodynamic analysis. Annual report, September 1983-February, 1985.** Berry, R.S. (Chicago Univ., IL (USA)). Mar 1985. 174p. NTIS, PC A08/MF A01.

The objectives of this project are to develop methods for the evaluation of syntheses of gaseous fuels in terms of their optimum possible performance, particularly when they are required to supply those fuels at nonzero rates. The first objective is entirely in the tradition of classical thermodynamics, the processes, given the characteristics and constraints that define them. The new element which this project introduces is the capability to set limits more realistic than those from classical thermodynamics, by the inclusion of the influence of the rate or duration of a process on its performance.

The development of these analyses is a natural step in the evolution represented by the evaluative papers of Appendix IV, e.g., by Funk et al., Abraham, Shinnar, Bilgen and Fletcher. A second objective is to determine how any given process should be carried out, within its constraints, in order to yield its optimum performance and to use this information whenever possible to help guide the design of that process.

43933 **(PNL-SA—12841) Biomass gasification research: recent results and future trends.** Schiefelbein, G.F. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 26p. (CONF-8504166—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015804.

From Woodgas in practice seminar - forest products research international symposium; Pretoria, South Africa (22 Apr 1985).

This paper briefly reviews recent research results on the gasification of biomass and prospects for commercial application of these results. Particular emphasis is placed upon current biomass gasification research sponsored by the US Department of Energy. The main thrust of this research is directed toward the production of medium energy gases containing 12 to 21.5 MJ/NM^3. This research effort features both directly heated and indirectly heated gasification concepts. Fixed-bed, fluid-bed, and entrained gasification reactors operating at ambient and elevated pressures are being explored. Other gasification research are addressed. 8 refs., 9 figs., 6 tabs.

43934 **(PNL-SA—13200) Development of water slurry gasification systems for high-moisture biomass.** Butner, R.S.; Elliott, D.C.; Sealock, L.J. Jr. (Pacific Northwest Labs., Richland, WA (USA)). May 1985. Contract AC06-76RL01830. 25p. (CONF-850513—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016278.

From Symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1985).

The development of a new biomass gasification system by Pacific Northwest Laboratory is described. The system promises to allow the efficient thermochemical conversion of high-moisture biomass feedstocks. The reactor operates at 400 to 450°C and 4000 to 5000 psig to allow the gasification of water-biomass slurries containing up to 95% moisture. Initial results of gasification studies are presented. Raw product gases containing up to 95% moisture. Initial results of gasification studies are presented. Raw product gases containing up to 40% methane have been obtained with carbon conversions in excess of 95%. Feedstocks being studied include aquatic plants, agricultural residues, food processing waste and effluent from an anaerobic methane digestor. 11 refs., 4 figs., 4 tabs.

43935 **(PNL-SA—13281) Direct conversion of biomass to liquids by thermal processes.** Stevens, D.J.; Schiefelbein, G.F. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 12p. (CONF-850773—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016611.

From American Society of Agricultural Engineers; East Lansing, MI, USA (8 Jul 1985).

Biomass is an important energy resource at present and offers excellent potential for increased energy impact in the future. This potential energy impact is expected to be met in part by liquid fuels derived from biomass. Liquid fuels are more energy dense than biomass itself and more closely match existing end-use patterns. In this paper, research sponsored by the US Department of Energy's Biomass Energy Technology Division, on the direct thermochemical conversion of biomass to liquid fuels is discussed. Both the conversion of biomass to a bio-crude oil and subsequent product upgrading to hydrocarbon-compatible fuels are addressed. 19 refs., 8 figs., 3 tabs.

43936 **(SERI/PR—231-2762) SERI biofuels program. Quarterly technical report, second and third quarters, FY 1985.** Bull, S.R.; Lowenstein, M.Z.; McIntosh, R.P. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1985. Contract AC02-83CH10093. 105p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85016850.

Highlights of progress accomplished during the second and third quarters of FY 1985 in the areas of aquatic species, anaerobic digestion and photobiological hydrogen production research are summarized. The following accomplishments were attained in aquatic species research: evaluation of the growth of marine species in desert saline waters; preliminary evaluation of potential gains in productivity from utilization of light modulation; determined the relationship between the initial carbohydrate accumulation and subsequent lipid synthesis in Ankistrodesmus; completed designs and analysis of three outdoor systems; completed evaluations on the use of immobilized systems for the production of fuels; completed economic and technical evaluation of two harvesting schemes for microalgae; and completed evaluation of macroalgal production concepts and submit research plan. In the area of anaerobic digestion research, the following tasks were accomplished: received final report on autohydrolysis; received final report on genetic engineering of methanogens; completed computerized data based on commercial anaerobic digesters; completed analysis of anaerobic digestion for energy and submitted draft white paper to DOE program managers; and made presentations on "Anaerobic Digestion for Energy" and "Potential for Improvement of Anaerobic Digestion Technology" to DOE program managers. In photobiological hydrogen production, program wrap-up was completed and a final draft of the program report was submitted.

43937 **Moessbauer spectroscopy observations of local temperature rises in a silica-supported iron catalyst.** Matyi, R.J.; Butt, J.B.; Schwartz, L.H. (Northwestern Univ., Evanston, IL). *Journal of Catalysis;* **91**: No. 2, 185-196(Feb 1985). Contract AC02-78ER04993.

Moessbauer spectroscopy has been used to observe the local (or microscopic) temperature of a silica-supported iron catalyst used in the Fischer-Tropsch synthesis reaction. The internal magnetic field of the iron carbide crystallites, measured while the catalyst was situated in an in-situ cell, was used to measure temperature of the crystallites under reaction conditions. At nominal bulk temperatures of 275 and 300°C, temperature rises of 13 and 19°C were recorded when the gas flow to the catalyst was changed from helium to the $3H_2$/CO reaction mixture. These local temperature rises of the supported crystallites were in contrast to observed decreases in the bulk catalyst temperature when the reaction mixture was introduced. The iron carbide crystallites transformed from the ϵ' phase to the more stable chi-carbide after prolonged treatment in helium. 26 refs., 9 figs., 4 tabs.

43938 **Silica-supported iron nitride in Fischer-Tropsch reactions.** Yeh, E.; Jaggi, N.K.; Butt, J.B.; Schwartz, L.H. (Northwestern Univ., Evanston, IL). *Journal of Catalysis;* **91**: No. 2, 231-240(Feb 1985). Contract AC02-78ER04993.

The techniques of Moessbauer effect spectroscopy and wide angle x-ray diffraction have been applied to characterize nitrided iron catalysts (initial composition $\approx Fe_2N$) supported on silica gel and used in the synthesis reaction. Moessbauer spectroscopy shows that the nitride catalyst becomes iron-rich during the first 3 h of reaction in the syngas environment ($CO:H_2 = 1:3$, T = 250°C, 7.8 atm) indicating that nitrogen atoms are removed more rapidly by H_2 than they are simultaneously replaced by carbon atoms. After 3 h carburization becomes dominant, the carbon concentration increases, and the catalyst composition stabilizes after about 18 h of reaction. The analysis of the 4.2 K Moessbauer spectrum and x-ray diffraction of an equilibrated catalysts after 49 h of reaction gives a composition of Fe/sub 2.18/C/sub 1-y/N/sub y/, where y was estimated to be between 0.13 and 0.20. 30 refs., 4 figs., 3 tabs.

43939 **Silica-supported iron nitride in Fischer-Tropsch reactions. II. Comparison of the promotion effects of potassium and nitrogen on activity and selectivity.** Yeh, E.B.; Schwartz, L.H.; Butt, J.B. (Northwestern Univ., Evanston, IL). *Journal of Catalysis;* **91**: No. 2, 241-262(Feb 1985).

The performance of silica-supported iron catalysts promoted by potassium and nitrogen has been studied for the conversion of CO to hydrocarbons. Reactions were investigated at 250°C and 1, 7.8, and 14 atm in a differential conversion range of less than 6%. Significant differences exist in the behavior of these supported catalysts in comparison to prior studies of fused or precipitated materials. It was found that an unpromoted Fe-carbide catalyst was more active at lower pressures and less active at higher pressures than

the nitrided catalyst. Moreover, it was found that potassium-promoted catalysts were less active than catalysts without potassium. Both Fe-nitride and potassium-promoted catalysts showed higher olefin selectivities, higher water-gas shift activity, lower alcohol yields, and larger proportions of higher molecular weight products than their unpromoted counterparts. The product distributed parameters are presented for all catalysts at different pressures and conversion levels. The significance of the incorporation of alcohols into the distribution plot is discussed and a mechanism for alcohol formation is proposed. The effect of nitrogen on the catalytic reaction is discussed in terms of a donor model theory in which nitrogen atoms donate electrons to the iron d band. From the product distribution of the supported Fe-nitride and potassium-promoted catalysts, it is concluded that nitrogen and potassium have similar promoting function on the Fischer-Tropsch reactions and further that an additive effect is observed for Fe-K-nitride catalysts. 31 refs.

43940 **Opportunities for health and environmental research from an industrial perspective.** Vick, G.K. (Exxon Research and Engineering Company, Florham Park, NJ). pp 557-562 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (Oct 1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

This chapter considers research requirements and priorities in the area of health and environmental studies in synthetic fuel technologies from the perspective of industry. A conceptual framework is developed for examining the kinds of decisions with which industry is faced and the kinds of health and environmental R&D data needed for those decisions. Some of the more obvious knowledge gaps are then identified within this framework.

43941 **Status of and prospects for synthetic fuels research and production.** Dugan, J.V. (House Committee on Science and Technology, Subcommittee on Energy Research and Production). pp 551 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (Oct 1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

Environmental, health, and safety research in support of synthetic fuels technology and other aspects of synthetic fuels research and production are discussed in this chapter from the perspective of the House Science and Technology Committee and from the specific perspective of Rep. Marilyn Lloyd Bouquard, Chairman of the Energy Research and Production Subcommittee, which is relatively supply oriented.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 44281

43942 **(BMFT-FB-T—85-054) Chemical raw materials from coal; development of a process for the production of higher oxygen-containing compounds from methanol - laboratory stage.** Bahrmann, H.; Lipps, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1985. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752671.

In view of the hitherto insufficient yields from the homogeneously catalysed reaction of methanol with synthesis gas to ethanol (homologation, hydrocarbonylation) the experiments were aimed at increasing the yield (development of highly active, highly selective catalyst). The catalyst to be developed werw to be readily available at reasonable prices and suitable for use in a technical process. As the experimental research and development work has shown, it is possible to achieve appreciably higher yields of ethanol with the newly developed catalysts under defined reaction conditions in small autoclaves as compared with the status of technology known at the beginning of the project. The synthesis should be tested and optimised in continuous operation (pilot-scale reactors) when the economic prerequisites have changed.

43943 (CONF-801197—, pp 95-102) **Continous alcohol fermentation.** Edvalson, T. (Eastern Oregon State Univ.). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The author describes a project to build and operate a small-scale continuous alcohol distillery for use on farms. The system requires a minimum of labor, will process multifeedstocks and will store a minimum of 1 day's production capacity. (DMC)

43944 **(DOE/ID/12519—T1) Development of a process to produce chemicals from lignocellulose. Final report.** Allen, B.R.; Dawson, W.J.; Jenkins, D.M. (Battelle Columbus Labs., OH (USA)). 26 Jun 1985. Contract AC07-84ID12519. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017028.

This report is Battelle Columbus Laboratory's (BCL) final report on a research program to investigate the technical and economic feasibility of a conceptual process for the conversion of cellulose and hemicellulose in waste materials to higher value chemicals, such as lactic and acetic acids. The conceptual conversion process was based upon previous studies by Battelle on the conversion of simple sugars to ethanol via a thermochemical process. This process involved the production of lactic acid as an intermediate. The major technical issue of this project, which was not addressed in the previous work, was to determine whether the direct conversion of cellulose and hemicellulose to lactic and acetic acids was technically feasible. This research program was developed to answer the technical feasibility question and to provide a very preliminary evaluation of the process economics. This very preliminary investigation has demonstrated that the conversion process does have technical and economic merit. The major technical goal, that of demonstrating the feasibility of the direct conversion of cellulose to lactic and acetic acids, without first hydrolyzing the cellulose to glucose, was achieved. Direct conversion of waste materials, in yields of about 35 to 40% was achieved and was equal to or higher than the yield from pure cellulose. 2 refs., 8 figs., 9 tabs.

43945 **(DOE/IR/10295—T7) Alcohol fuels production, manpower, and education: where do two-year colleges fit.** (American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center). 1981. Contract FG05-79IR10295. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017403.

This booklet cumulates issues drawn from a March 6, 1981, conference addressing issues facing two-year colleges as they prepare manpower training for future leaders in alcohol fuel technology. The issues apply to all energy programming. National, regional and local energy circumstances touch all of society. What programs, information centers and community cooperation must be mustered to provide an advocacy of development of one energy resource over another. (PSB)

43946 **(SERI/TR—232-2386) Evaluation of concentrated halogen acid hydrolysis processes for alcohol fuel production.** Wright, J.D.; Power, A.J.; Bergeron, P.W. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85012153.

Cellulose may be hydrolyzed by acid to form glucose, which can then be fermented to produce ethanol. Dilute acid processes have relatively low yields (55 to 75%) because the rate of sugar degradation is rapid at the high temperatures necessary for the hydrolysis of crystalline cellulose. In low-temperature, concentrated-acid processes, the crystalline cellulose is decrystallized, allowing the hydrolysis reaction to occur at much lower temperatures where sugar degradation is negligible. Therefore, the concentrated-acid proceses give high yields and produce relatively clean hydrolyzates. Concentrated-acid hydrolysis may be carried out either with hydrochloric acid, hydrofluoric acid, or sulfuric acid. This report evaluates three halogen acid hydrolysis processes: liquid-phase HCl, gas-phase HCl, and liquid-phase HF. The processes are compared on the basis of the predicted selling price of ethanol produced. This report applies a consistent balance-of-plant design and set of eco-

nomic assumptions to different processes to provide insights into the important internal parameters and the relative advantages and disadvantages of each. 49 refs., 20 figs., 21 tabs.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 43983

43947 (CONF-8211193—, pp 14-25) **Energy properties of wood.** Baker, A.J. (Forest Products Lab., Madison, WI). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

The fuel properties of wood can be summarized by ultimate and proximate analysis and determination of the high heating value. It is not valid to list these values for species since a species has not been adequately sampled and tested. Enough is known, however, to say that softwoods have a high heating value of about 9000 Btu per pound; whereas hardwoods have a value of about 8600 Btu per pound. These values are probably within about +5% of a value expected for a specific sample. The ultimate analysis for wood is about 50% carbon, 6% hydrogen, and 44% oxygen on a moisture and ash free basis. Wood densification is a method to increase the bulk density and to decrease the handling problems associated with fuel chips, sawdust, and shavings. Fuel briquettes, pellets, and fire logs are usually made without a binder from finely divided dry wood and bark. Some fire logs are molded from a mixture of about one-half wax and one-half milled dry wood. About 850,000 tons per year of charcoal briquettes are produced annually from a mixture of mainly wood and bark charcoal, starch binder, and various amounts of lignite charcoal, clay and sawdust. Wood gasifiers have the potential for providing all the fuel needs for small oil- or gas-fired boilers and supplemental fuel for large boilers. Pyrolysis and hydrolysis processes have the potential for production of some chemicals now obtained from petroleum. At this time the processes are not proven, and they need to be demonstrated on pilot and pre-commercial plant scale before they can be scaled up to commercial size.

43948 (DOE/METC—84-34, pp 105-112) **Rehabilitating the Tampa municipal incinerator to a refuse-to-energy facility.** Garrity, R.D.; McCann, N.; Murdoch, J.D. (City of Tampa, FL). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

The City of Tampa has begun construction of the McKay Bay Refuse-to-Energy Facility. The Facility will be a 1000 ton per day mass-burn incinerator which will dispose of all processible municipal solid waste from the City of Tampa and possibly some neighboring areas, and will generate electricity to provide revenues to partially offset the costs of incineration. The Facility will have a 22.8MW turbine generator, and will generate enough electricity to satisfy the electrical needs of approximately 10,000 homes, replacing the equivalent of approximately 290,000 barrels of oil per year. The Facility price in October, 1981 dollars (the time bids were received) is $59,852,000. An additional cost of $3,625,000 (also 1981 dollars) is estimated for City related facilities such as street modifications, scale equipment, utility connections, electrical interconnection lines, and a transfer station. For the purpose of the bond issue, an inflation adjustment cost of $17,425,000 was estimated through the scheduled construction period. Waste Management, Inc., under a full-service contract to the City, will design, construct, and operate the Facility for 20 years. Once the Facility is operational, the City will pay Waste Management, Inc. an established operating fee per ton of solid waste disposed of at the Facility, plus 10% of the electricity revenues generated by the Facility. Project planning, vendor selection, vendor contracts, energy market contracts, and system financing are discussed in detail.

43949 (DOE/METC—84-34, pp 377-386) **Potential for disposal of plant waste agglomerates in spreader stoker boilers.** Garvin, J.P. (Green International, Inc., Sewickley, PA). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

This paper is concerned with presenting a concept and discussing its possible application. The concept is the agglomeration of industrial plant wastes in a plant having an operating spreader-stoker boiler. Such a concept has a number of potential advantages. An important consideration in such a process is the strength of the agglomerates, or pellets, which are produced. The paper describes the variables which affect pellet strength, based on original laboratory work. Process economics are also an important consideration and are discussed. 4 references, 5 tables.

43950 (DOE/METC—84-34, pp 432-442) **Statistical analysis of properties, combustion products, and emissions from combustion of municipal solid waste.** Hasselriis, F. Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

Municipal solid waste (MSW) is a highly variable mixture. This variability must be taken into account in order to obtain reasonably accurate estimates of quantity and quality, as well as daily, weekly, monthly and seasonal variations of waste streams. When MSW is destroyed by combustion, corresponding variations are noted in the composition and nature of the bottom ash, the collected fly ash, and in the particulate and gaseous emissions. There is a relationship between MSW properties and emissions, but the process of combustion does influence the form and point of discharge of the non-combustibles and reacted components. This paper presents an analysis of data reported from various sources which show that most of the variations follow log normal distributions and plot as straight lines on Rosin-Rammler or log probability paper. These graphical presentations are useful in understanding the nature of the variability and the probable range of variation, in obtaining accurate estimates of the mean value of composition and properties, in identifying outliers, and factors which cause the variations. 6 references, 7 figures.

43951 (DOE/METC—84-34, pp 491-504) **Solid waste processing for the recovery of secondary materials and energy.** Savage, G.M.; Diaz, L.F. (Cal Recovery Systems, Inc., Richmond, CA). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

Municipal solid waste (MSW) can be a substantial source of secondary materials and energy when technical and economical means for their recovery are available. Unfortunately, even when the means are available, this resource potential is underexploited. The equipment and systems most commonly used to recover material and energy from MSW are discussed in this paper. The discussion includes a review of the state-of-the-art of solid waste processing as well as some words about recovery and conversion technologies for the future. Additionally, a methodology is given for modeling the performance of refuse processing systems such that judgments as to their effectiveness can be made. The basic unit operations for waste processing are described in terms of their capacity with respect to handling MSW and to segregating components for eventual reuse or for energy conversion. Feasible processing technologies are discussed in terms of the opportunities for recovering cellulosic components for use as feedstocks in the chemical and pulp and paper industries, and for the recovery of refuse derived fuel (RDF). 10 references, 6 tables.

43952 (DOE/OR/21389—T2) **Stack emission standards for industrial wood-fired boilers. Final report.** Weston, R.F. (Weston (Roy F.), Inc., West Chester, PA (USA)). [1985]. Contract FG05-83OR21389. 226p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85015215.

This study addresses the fundamental technical, economic, and regulatory issues associated with the control of pollutant emissions from wood-fired boilers in the Northeast. It serves the purpose of providing the best current emission test data and analysis materials available for industrial wood fuel combustion. Heretofore, this information was lacking as a single source document, resulting in an inconsistent and sometimes inappropriate data baseline on which state emission standards were developed or modified. Uncertainty surrounding state air regulations has led to confusion for

small to moderate-sized industries considering conversion of boilers from fossil-fuel to wood. Results of the study show that the use of wood as a boiler fuel is typically limited to industries generating wood residue. Less than 10% of industrial boilers are fueled by wood. Most wood-fired boilers have a capacity of less than three million Btu per hour. Wood is an environmentally sound alternative to fossil fuels. Particulate matter is the major pollutant of concern. Federal air pollution regulations generally will not apply to small wood-fired boilers which meet state emission standards. State emission standards vary substantially in content, purpose, and impact on industry. Compliance with stringent emission standards can be achieved through the application of controls. Compliance with less stringent emission standards can be achieved via good boiler and appurtenance design and operation. The economic impact of employing emission controls becomes greater as the boiler capacity decreases. This report also provides industry with guidelines for implementation of wood-fired boilers.

43953 **(EPRI-CS—4023) Alternative fuel firing in an atmospheric fluidized-bed combustion boiler. Final report.** Miraglio, A.; Tegen, P. (Northern States Power Co., Minneapolis, MN (USA)). Jun 1985. 145p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920827.

In 1981, Northern States Power Company converted its 15 MW French Island Unit No. 2 from a stoker-fired boiler to an atomspheric fluidized bed combustor designed to burn wood waste. A joint project between Northern States Power and the Electric Power Research Institute was subsequently established to determine the impact on operations, performance, and emissions of cofiring a variety of low-grade waste fuels with wood waste in this unit. Alternate waste fuels fired were shredded rubber tires, shredded railroad ties, refuse derived fuel, Minnesota peat, and sewage sludge. Each fuel was cofired with wood waste under steady boiler conditions for 50 to 100 hours. Results from the initial alternate fuel tests showed incomplete combustion of the fluidized bed combustor. To correct this problem the overfire air system was modified to improve mixing in the furnace volume above the fluidized bed. After the overfire air system was modified, the fluidized bed combustor proved able to burn all waste fuels effectively, except rubber tires which were not re-tested. Fuel handling problems were encountered with refuse derived fuel, peat and sewage sludge, but did not prevent their successful firing. Fluidized bed contamination was experienced with steel wire from rubber tires and stones and steel pieces from railroad ties. Also, the particulate scrubber was overloaded when firing high ash fuels such as rubber tires and peat. 2 refs., 21 figs., 32 tabs.

43954 **(EPRI-CS—4164-Vol.1) Sumner County solid-waste energy recovery facility. Volume 1. Feasibility studies, design, and construction. Final report.** (Tennessee Valley Authority, Chattanooga (USA)). Aug 1985. 117p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920809.

This report summarizes the history leading to operation of the 200 ton per day municipal solid waste energy recovery cogeneration facility located at Gallatin, Tennessee. The report documents key milestones and feasibility studies that led to the development, design, and construction of this cogeneration facility which is owned and operated by the Resource Authority in Sumner County. A preliminary study completed in October 1977 by Sanders and Thomas, Inc., showed that the facility would be feasible. Feasibility, economics, and conceptual design were further confirmed by R.W. Beck and Associates. An equipment description of the mass burn system is given which includes the water-cooled rotary combustor manufacturated by O'Connor Combustor Corporation, and an electrostatically assisted baghouse designed by the Apitron Division of American Precision Industries. A "fast track" design and construction method provided initial startup just 18 months after ground breaking. Initial construction and engineering costs were $9.8 million, but additional funding was required to retrofit original equipment. The project received grants of $250,000 from DOE, $1.5 million from EDA, and a loan of $2 million from TVA in addition to the $12 million tax exempt revenue bonds issued by the Resource Authority. The facility has processed all MSW collected in Sumner County since March 1982, and additional waste from nearby counties is being accepted. 6 figs., 22 tabs.

0905 Liquid Waste Fuels

43955 **(BMFT-FB-T—85-057) Development of an analytical apparatus and analytical methods for the combustion of chemical residues and wastes.** Ehrenberger, F.; Heil, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1985. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752669.

In the given project a laboratory apparatus was developed for simulation of the large scale technical combustion of residues. Liquid, highly halogenated production residues were burned in numerous experiments under varying conditions (temperature, amount of oxygen and sample). The reaction products of the combustion were qualitatively and quantitatively analysed with help of special analytical methods. The results give important knowledge and indications for pollutantsfree combustion of halogenated organic compounds and contribute to the elucidation of the often controversal discussion of environmental effects of these chemicals. If optimal conditions of combustion were used (combustion temperature >1200°C, a minimum demand of oxygen, homogeneity of the system fuel-gas/vaporized product), no emissions were detected (emission less than the detection limit).

13 HYDRO ENERGY

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 44139

1305 Economics And Management

REFER ALSO TO CITATION(S) 44505

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 45187, 45189, 45190, 45191

43956 **(DOE/BP—314) Wildlife impact assessment and mitigation summary: Montana Hydroelectric Projects. Volume I. Libby Dam. Final report.** (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Oct 1984. Contract AI79-83BP11983. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85016227.

This assessment addresses the impacts to the wildlife populations and wildlife habitats due to the Libby Dam project on the Kootenai River and previous mitigation of these losses. The current assessment documents the best available information concerning the impacts to the wildlife populations inhabiting the project area prior to construction of the dam and creation of the reservoir. Many of the impacts reported in this assessment differ from those contained in the earlier document compiled by the Fish and Wildlife Service; however, this document is a thorough compilation of the available data (habitat and wildlife) and, though conservative, attempts to realistically assess the impacts related to the Libby Dam project. Where appropriate the impacts resulting from highway construction and railroad relocation were included in the assessment. This was consistent with the previous assessments.

43957 **(DOE/BP—316) Wildlife impact assessment and summary of previous mitigation related to hydroelectric projects in Montana, Phase I. Volume IIA. Clark Fork projects: Thompson Falls Dam. Final report.** (Montana Dept. of Fish, Wildlife and Parks, Helena (USA)). Oct 1984. Contract AI79-83BP11983. 63p. NTIS, PC A04/MF A01. File Number DE85016268.

The Thompson Falls Dam inundated approximately 347 acres of wildlife habitat that likely included conifer forests, deciduous bottoms, mixed conifer-deciduous forests and grassland/hay meadows. Additionally, at least one island, and several gravel bars were inundated when the river was transformed into a reservoir. The loss of riparian and riverine habitat adversely affected the diverse wildlife community inhabiting the lower Clark Fork River

area. Quantitative loss estimates were determined for selected target species based on best available information. The loss estimates were based on inundation of the habitat capable of supporting the target species. Whenever possible, loss estimates bounds were developed by determining ranges of impacts based on density estimates and/or acreage loss estimates. Of the twelve target species or species groups, nine were assessed as having net negative impacts. 86 refs., 2 figs., 5 tabs.

43958 **(DOE/BP—319) Status review of wildlife mitigation Columbia Basin hydroelectric projects: Washington Facilities (Intrastrate). Final report.** Howerton, J.; Jordan, M.; Kraege, D.; Rybak, E.; Starkey, R.; Van Lom, G. (Washington Dept. of Game, Olympia (USA); Fish and Wildlife Service, Portland, OR (USA)). Nov 1984. Contract AI79-84BP12149;AI79-84BP12914. 234p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85016228.

This report was prepared for BPA in fulfillment of section 1004 (b)(1) of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, to review the status of past, present, and proposed future wildlife planning and mitigation program at existing hydroelectric projects in the Columbia River Basin. The project evaluations will form the basis for determining any needed remedial measures or additional project analysis. Projects addressed are: Merwin Dam; Swift Project; Yale Project; Cowlitz River; Boundary Dam; Box Canyon Dam; Lake Chelan; Condit Project; Enloe Project; Spokane River; Tumwater and Dryden Dam; Yakima; and Naches Project.

43959 **(DOE/BP—343) Imprinting salmon and steelhead trout for homing. Annual report, 1983.** Slatick, E.; Gilbreath, L.G.; Harmon, J.R.; McCutcheon, C.S.; Bjornn, T.C.; Ringe, R.R. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). Nov 1983. Contract AI79-82BP39646. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016231.

The National Marine Fisheries Service (NMFS), under contract to the Bonneville Power Administration, began conducting research on imprinting Pacific salmon and steelhead for homing in 1978. In the juvenile marking phase, over 4 million juvenile salmon and steelhead were marked and released in 23 experiments. The primary objectives were to determine a triggering mechanism to activate the homing imprint, if a single imprint or a sequential imprint is necessary to assure homing, and the relationship between the physiological condition of fish and their ability to imprint. Ten experimental studies are discussed. Six of the studies employed a variety of techniques for imprinting fish. The remaining four tested the feasibility of imprinting fish by a short-distance voluntary migration before transport. In five experiments, survival was enhanced by the imprint-transportation procedures, and homing to the homing site area was partly successful. Returns from the Astoria, Oregon, release of fall chinook salmon from Big Creek Hatchery (Knappa, Oregon), for example, showed that limited short distance migration imprinting should provide 2-3 time more fish to the various fisheries while providing adequate returns to the hatchery for egg take each year. 21 refs., 12 figs, 12 tabs.

43960 **(DOE/BP—345) Use of a fish transportation barge for increasing returns of steelhead imprinted for homing, 1983. Annual report.** Harmon, J.R.; Slatick, E. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). Mar 1984. Contract AI79-83BP39643. 75p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016338.

A study was conducted to determine if transporting steelhead, Salmo gairdneri, smolts by barge from Dworshak National Fish Hatchery to a release site in the Columbia River below Bonneville Dam would result in increased returns of adults to the fishery and hatchery. Eight separately identifiable groups of about 30,000 steelhead each were marked and released in 1982. During 1983, over 251,000 smolts were marked - about 30,000 fish for each of four test lots (barged) and four control lots (released into the Clearwater River near the hatchery). The health and status of smoltification of the juvenile fish were monitored from March to the release date for each group. The fish sampled were considered to be in good health and well advanced in smoltification at release. Fish from the control release were recovered at dams and in the estuary along their migration route. Approximately 29% of the fish from the control release were transported from collector dams (Lower Granite, Little Goose, and McNary) as part of the routine transportation program. The relatively large number of 1-ocean age adult steelhead (179) recovered at adult collector dams (Lower Granite, McNary, and Bonneville) and in the Indian fishery (Columbia River Zone 6) indicates a high survival of steelhead released as smolts in the spring of 1982. A large return of 2-ocean age adults is expected in 1984. 3 refs.

43961 **(DOE/BP—346) Snake River Fall Chinook Salmon Broodstock Program, 1983. Annual progress report.** Harrell, L.W. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). Mar 1984. Contract AI79-83BP39642. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016329.

The objective of the Snake River Fall Chinook Salmon Broodstock Program is to hatch eggs from upriver stocks, rear the fish to maturity and spawning, and use the eggs for restoration purposes in the Snake River. Approximately 15,000 eyed eggs for 1980- and 1981-brood Snake River fall chinook salmon were obtined each winter in 1980 and 1981. Approximately 13,000 "button-up" fry from the 1982 brood were received in March 1983. Since August 1983, the mortality in the 1980-brood fish in marine net-pens has been unusually high. These losses are related to a systematic infection with a previously unreported fungal pathogen. Also responsible for considerable mortality are the approximately 25% maturing males in the population. As of 16 December 1983, 1917 1980-brood Snake River fall chinook salmon, averaging 1050 g, are being maintained in marine net-pens at the Manchester Marine Experimental Station, Manchester, Washington. Currently, 4090 1981-brood chinook salmon with an average weight of 200 g are in net-pens at Manchester. The new fungal disease has also been observed in these fish, but it is causing minimal mortality. Approximately 6000 1982-brood fish (15 g average weight) are currently at the Big Beef Creek Research Station, Seabeck, Washington, or have been acclimated to seawater. All the fish will be in marine net-pens at Manchester by May 1984. 2 figs.

43962 **(DOE/BP—365) Compendium of low-cost Pacific salmon and steelhead trout production facilities and practices in the Pacific Northwest.** Senn, H.; Mack, J.; Rothfus, L. (Fish Management Consultants, Olympia, WA (USA)). Oct 1984. Contract AC79-83BP12745. 513p. NTIS, PC A22/MF A01; GPO Dep. File Number DE85017145.

The purpose was to research low capital cost salmon and steelhead trout production facilities and identify those that conform with management goals for the Columbia Basin. The species considered were chinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), sockeye salmon (O. nerka), and steelhead trout (Salmo gairdneri). This report provides a comprehensive listing of the facilities, techniques, and equipment used in artificial production in the Pacific Northwest. (ACR)

43963 **(DOE/BP—366) Wildlife and wildlife habitat mitigation plan for Hungry Horse hydroelectric project. Final report. Volume III. Hungry Horse Dam.** Bissell, G.; Yde, C.A. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Jan 1985. Contract AI79-83BP11983. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016234.

This report describes the proposed mitigation plan for wildlife losses attributable to the construction of the Hungry Horse hydroelectric project. In this report, mitigation objectives and alternatives, the recommended mitigation projects, and the crediting system for each project are described by each target species. Mitigation objectives for each species (group) were established based on the loss estimates but tailored to the recommended projects. 13 refs., 3 figs., 19 tabs.

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43964 **(DOE/BP—367) Wildlife and wildlife habitat mitigation plan for Libby hydroelectric project. Final report. Volume I. Libby Dam.** Mundinger, J.; Yde, C. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Jan 1985. Contract AI79-83BP11983. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016532.

This report describes the proposed mitigation plan for wildlife losses attributable to the construction of the Libby hydroelectric project. Mitigation objectives and alternatives, the recommended mitigation projects, and the crediting system for each project are described by each target species. The report describes mitigation that has already taken place and 8 recommended mitigation projects designed to complete total wildlife mitigation. 8 refs., 2 figs., 12 tabs.

43965 **(DOE/BP—369) Status review of wildlife mitigation Columbia Basin hydroelectric projects. Columbia River mainstem facilities. Final report, 1984.** Howerton, J.; Hwang, D.; Jordan, M.; Rybak, E.; Sill, D.; Starkey, R.; Van Lom, G.; Wright, P. (Fish and Wildlife Service, Portland, OR (USA); Washington State Dept. of Game, Olympia (USA)). Dec 1984. Contract AI79-84BP12149;AI79-84BP12914. 411p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85016325.

This report reviews the status of past, present, and proposed future wildlife planning and mitigation programs at existing hydroelectric projects in the Columbia River Basin. The project evaluations will form the basis for determining any needed remedial measures or additional project analysis. Each hydropower facility report is abstracted separately for inclusion in the Energy Data Base.

43966 **(DOE/BP/10062—T1) Impacts of water levels on breeding Canada geese and the methodology for mitigation and enhancement in the Flathead drainage. Annual report, 1984.** Mackey, D.L.; Matthews, W.C. Jr.; Gregory, S.K. (Confederated Salish and Kootenai Tribes, Pablo, MT (USA)). Mar 1985. Contract AI79-83BP10062. 142p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85016230.

The lower Flathead System Canada Goose Study was initiated to determine population trends and the effects of water level fluctuations on nest and brood habitat on the southern half of Flathead Lake and the lower Flathead River as a result of the operations of Kerr Dam. This report presents data collected during the 1984 field season as part of an ongoing project. Geese used Pablo, Kicking Horse, Ninepipe Reservoirs heavily during late summer and fall. Use of the river by geese was high during the winter, when the reservoirs were frozen, and during the breeding period. Most breeding geese left the river after broods fledged. Thirteen percent of the artificial tree nest structures on the river were used by nesting geese. Goose nest initiation on the river peaked the last week in March through the first week in April, and hatching peaked the first week in May. Predation was the most significant cause of nest loss on the river, and nest loss by flooding was not observed. Avian predation was the single largest factor contributing to nest loss on the lake. Habitat use was studied in 4 brood areas on the river and 8 brood areas on the lake, and available habitat was assessed for 2 portions of both the lake and the river. Brood habitat use was significantly different from the available habitat in all areas studied. On the lower river, broods used wheat fields, gravel bars, and shrub habitats. On the upper river, coniferous forest and shrub habitats were preferred. On the West Bay of the lake, brood areas consisted primarily of lawns and tall herbaceous habitat, while on the South Bay, marshes dominated the brood areas studied. Water levels on the river and lake affect both accessibility of these areas to brooding geese, and the ecology of the habitats preferred by geese. 43 refs., 24 figs., 31 tabs.

43967 **(DOE/BP/11797—3) Adult fishway inspections on the Columbia and Snake Rivers 1984.** Basham, L.R. (Water Budget Center, Portland, OR (USA)). Aug 1985. Contract AC79-84BP11797. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017316.

Mainstream projects which have adult fish passage facilities are inspected by project operators, fishway attendants, and state and federal fishery agencies. The overall movement of upstream migrants in 1984 appeared to be satisfactory with few delays. Special efforts were made by fishery agencies and Corps personnel to check on potential problems which appeared to exist at The Dalles and John Day Dams this year. However, adult passage facilities were operating "in criteria" and fish may have been delayed by temperature or other factors. Inspections were generally made once a month. Some projects were operating at less than full criteria as seen during inspections by fishery agencies this year. It appears that during periods of low tailwater, certain projects have difficulty maintaining proper head at main fishway entrances. Some main entrance gates bottom-out and water depth over these weirs are not up to desired criteria. Also it was noted that auxiliary water pumps were not being run at a rate to achieve the desired amount of water for attracting fish to the fish ladders and maintaining proper head at main fishway entrances.

43968 **(DOE/BP/11888—1) Development of rations for the enhanced survival of salmon. Annual report, 1984.** Crawford, D.L.; Lorz, H.; Westgate, J.; Lagasse, J.P.; Fairgrieve, W. (Oregon State Univ., Astoria (USA). Seafoods Lab.; Oregon Dept. of Fish and Wildlife, Corvallis (USA)). May 1985. Contract AI79-83BP11888. 67p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85015787.

This research was designed to establish the influence of feed regimes containing high quality animal protein complements on the efficiency of hatchery production and the return of coho and chinook salmon to the Columbia River system. The key to this feeding regime is the incorporation of low temperature-reduced pressure and/or spray dried fish proteins. It is belived such a feeding regime would yield optimum growth response and minimize nutritional stress yielding hardy high quality smolts of a more uniform and optimum size producing greater survival. 40 tabs.

43969 **(DOE/BP/12660—1) Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Annual report, FY 1984.** Shepard, B.B. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Jun 1985. Contract AI79-84BP12660. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016332.

We are evaluating the potential impacts of Libby Reservoir operation on the fishery in Libby Reservoir. The sampling program has been tested and modified to provide data for developing an understanding of how reservoir operation impacts the reservoir fishery. Temperature appears to be an important variable influenced by reservoir operation which regulates fish and fish food production and distribution. 39 refs., 21 figs., 19 tabs.

43970 **(DOE/BP/16687—1) Effects of water levels on productivity of Canada geese in the northern Flathead Valley. Annual report 1984.** Casey, D.; Wood, M. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Apr 1985. Contract AI79-84BP16687. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016337.

Operation of Hungry Horse Dam on the South Fork Flathead River causes sporadic level fluctuations along the main stem Flathead River. Seasonal water level fluctuations and substantial habitat losses have occurred as a result of construction and operation of Kerr Dam, which regulates Flathead Lake. These fluctuations may impact goose populations through flooding or erosion of nesting and brood-rearing habitats, and increased susceptibility of nests and young to predation. The number, location, and success of goose nests were determined through pair surveys and nest searches. Counts of indicated pairs suggest there were 73-125 occupied nests in the study area; 44 were located in 1984. Twenty were island ground nests, 19 were tree nests, and 5 were on man-made structures. Hatching success was 76 percent. Sixty-one percent of all nests were in deciduous forest habitat; 87 percent were on riparian bench or island landforms. Seventy-four percent of all nests were within 5 m of the seasonal high water mark (HWM) and 85 percent of ground nests were 1 m or less above the HWM. Production, habitat use, and distribution of broods were documented through aerial, boat, ground, and observation tower surveys. 28 refs., 10 figs., 4 tabs.

43971 **(DOE/BP/18968—1) Wildlife Impact Assessment Palisades Project, Idaho, February 1985. Final report.** Sather-Blair, S.; Preston, S. (Fish and Wildlife Service, Boise, ID (USA). Office of Ecological Services). Jun 1985. Contract AI79-84BP18968. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017052.

The Habitat Evaluation Procedures were used to evaluate pre- and post-construction habitat conditions of the US Bureau of Reclamation's Palisades Project in eastern Idaho. Eight evaluation species were selected with losses expressed in the number of Habitat Units (HU's). One HU is equivalent to one acre of prime habitat. The evaluation estimated that a loss of 2454 HU's of mule deer habitat, 2276 HU's of mink habitat, 2622 HU's of mallard habitat, 805 HU's of Canada goose habitat, 2331 HU's of ruffed grouse habitat, 5941 and 18,565 HU's for breeding and wintering bald eagles, and 1336 and 704 HU's for forested and scrub-shrub wetland nongame species occurred as a result of the project. The study area currently has 29 active osprey nests located around the reservoir and the mudflats probably provide more feeding habitat for migratory shore birds and waterfowl than was previously available along the river. A comparison of flow conditions on the South Fork of the Snake River below the dam between pre- and post-construction periods also could not substantiate claims that water releases from the dam were causing more Canada goose nest losses than flow in the river prior to construction. 41 refs., 16 figs., 9 tabs.

43972 **(DOE/BP/36717—2) Cumulative effects of microhydro development on the fisheries of the Swan River Drainage, Montana. Volume II. Technical information. Final report, 1985.** Leathe, S.A.; Bartelt, S.; Morris, L.M. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA). Fisheries Research and Special Projects Bureau). Jul 1985. Contract AI79-82BP36717. 118p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85015662.

This report summarizes a study to determine the potential cumulative effects of proposed small hydro development on the fisheries of the Swan River drainage. This report contains technical information and is a support document for the main report (Leathe and Enk, 1985). Consequently, discussion of results was minimized. The sections on fish population monitoring, streambed monitoring, habitat survey comparisons, and water temperature are the only portions that were not discussed in the main report. 5 refs., 55 figs., 44 tabs.

14 SOLAR ENERGY

43973 **(NRAS—70/UNUP-556) ASSET: abstracts of selected solar energy technology. Volume 7, No. 1.** Shearer, W. (ed.). (United Nations University, Tokyo (Japan)). 1985. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85901708.

The publication of ASSET is the initial phase of this information service. It contains abstracts of recent books, articles, reports and conference papers concerning solar, bioconversion and wind energy technologies and the socio-economic aspects of their utilization. Issues contain abstracts of recent publications balanced with those from the extensive older literature. Care is taken to include all available information applicable to rural communities in developing countries. Each issue also includes at least one complete reprinted paper.

1401 Resources And Availability

43974 **(DOE/ET/20153—80/1) Program for solar energy meteorological research and training site (Region 3). Annual progress report, 1 October 1979-30 September 1980.** Justus, C.G.; Kline, J.B.; Craig, J.I.; Schlag, J.M.; Lewis, L. (Georgia Inst. of Tech., Atlanta (USA). School of Geophysical Sciences). Dec 1980. Contract FG05-77ET20153. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85016940.

Data and analyses of one year (April 1979 - March 1980) of solar radiation data from the Atlanta Georgia Tech site are presented. Specific research results deal with: (1) intercomparison of the urban Georgia Tech site with data from the rural site at Shenandoah Georgia (separation 60km, 40 miles) for global (all sky) radiation, (2) model comparisons of the Watt model and Bird model for direct beam radiation against measured data, (3) a study of relative measurement errors for the Eppley PSP, Spectrolab SR75, Lambda LiCor, and Eppley 8-48, 4) global and direct radiation regressions versus percent available sunshine, (5) comparison of Campbell-Stokes and Foster Sunshine Switch measurements with pyrheliometer derived percent available sunshine, (6) comparison of isotropic versus anisotropic sky radiation for deriving solar radiation on a tilted surface versus measured data, (7) examination of various methods for plotting diffuse radiation versus other parameters, (8) display of observed variation of ultraviolet (0.30-0.39μ) radiation versus global radiation as a function of relative air mass and cloud cover, (9) annual time series and regression plotting techniques, and (10) examples of probability distribution and joint probability distribution statistics for daily averages, totals, maximum or minimums. Hourly, daily, and monthly values are tabulated in an appendix for direct, direct (RG630), global, global (RG630), diffuse, latitude tilted global, ultraviolet radiation, and available sunshine, for the period April 1979 to March 1980. Monthly averages of other meteorological and radiation parameters are also tabulated for this period.

43975 **(DOE/ET/20153—82/1) Solar energy meteorological research and training site (Region 3). Final report, 1 October 1981-30 September 1982.** Justus, C.G.; Lewis, L.J.; Paris, M.V.; Benson, R.B. (Georgia Inst. of Tech., Atlanta (USA)). Sep 1982. Contract FG05-77ET20153. 164p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85016466.

Data and analysis are presented for the period of operation April 1981-June 1982 for the Solar Energy Meteorological Research and Training Site (SEMRATS) program at the Atlanta Georgia Tech site. Hourly, daily, and monthly values are tabulated for direct, direct-spectral (RG630), global, global-spectral (RG630), diffuse, latitude-tilted global, ultraviolet radiation, and available sunshine, for this period. Monthly averages of other meteorological and radiation parameters are also tabulated for the entire operational period April 1979 - June 1982 and compared with results for the nearby Atlanta Airport National Weather Service station.

43976 **(DOE/R8/03056—T1) Solar intensity distribution in the upper hemisphere on a clear day near noon. Final report.** Fowlkes, C.W. (Fowlkes Engineering, Bozeman, MT (USA)). 01 Aug 1981. Contract FG48-81R803056. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85013339.

The goal of this project was to measure solar radiation (quasi) simultaneously at 144 positions of tilt and azimuth in the upper hemisphere. The apparatus consisted of a solar radiometer fixed to an articulating mechanism driven by stepping motors which were controlled by a low-cost microcomputer. At each 15° increment of altitude and azimuth, the radiant flux was sensed by the radiometer and the resulting electrical output digitized and stored in the computer. The upper hemisphere was scanned once each 30 seconds. At the end of each hour, the solar radiation measured in each direction was averaged and the result stored on magnetic tape. The data base consists of hourly averages of the solar flux on each of 144 planes. This paper describes the experimental apparatus and presents the results.

43977 **(FRNC-TH—1546) Description, measurement and modelling of solar input adapted to the general study of solar energy conversion systems.** Bachir-Raho, A. (Aix-Marseille-3 Univ., 13 - Marseille (France)). 1982. 126p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85750554.

This thesis proposes the description of a model for the distribution of overall and direct daily solar radiation in the time frequency domain for four examples of typical days. An analysis of the collection of data concerning solar input, and treatments of these data, modelling and the correlation of absolute measurement with traditional measurements is presented.

43978 **(PNL-SA—13094) Low-cost microprocessor controlled shadowband radiometer.** Michalsky, J.J.; LeBaron, B.A.; Harrison, L.C. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 6p. (CONF-850604—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016614.

From INTERSOL '85 - Solar energy--the diverse solution; Montreal, Canada (23 Jun 1985).

This paper describes the second phase in the development of a low-cost micro-processor-controlled rotating shadowband radiometer at PNL. The initial work, to develop a solar photometer, resulted in a mechanical design that is adopted for the solar radiometer with only minor changes. The goals of this effort were: (1) to improve the data acquisition system, and (2) to derive corrections for the silicon cell-based pyranometer that would allow measurements of total horizontal, diffuse horizontal, and direct normal solar radiation approaching first-class instrumentation accuracy at a fraction of the cost. Significant progress on temperature, cosine and spectral corrections has been achieved.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 43921, 43922, 43926, 43927, 43928, 43929, 43930, 43931, 43933, 43934, 43935, 43936, 43936, 43943, 43944, 43946, 43947, 43948, 43949, 43950, 43951, 43952, 44070, 44083, 44088, 44479, 44823, 44835

43979 **(BNL—36836) Application of electron-transfer theory to several systems of biological interest.** Marcus, R.A.; Sutin, N. (California Inst. of Tech., Pasadena (USA). Arthur A. Noyes Lab. of Chemical Physics; Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-8503159—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015835.

From Workshop on antennas and reaction centers of photosynthetic bacteria - structure, interactions and dynamics; Feldafing, F.R. Germany (23 Mar 1985).

Electron-transfer reaction rates are compared with theoretically calculated values for several reactions in the bacterial photosynthetic reaction center. A second aspect of the theory, the cross-relation, is illustrated using protein-protein electron transfers. 22 refs., 3 tabs.

43980 **(CEA-CONF—7583) Energy transfer in covalently linked and face to face bisporphyrins.** Mialocq, J.C.; Giannotti, C.; Maillard, P.; Momenteau, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 2p. (In French and English). (CONF-840812—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752376.

From International conference on photochemical combustion and storage of solar energy; Osaka, Japan (26 Aug 1984).

Published in summary form only.

43981 (CONF-801197—, pp 117-129) **Hybrid poplar energy potential.** Pye, E.K. (Univ. of Pennsylvania, Philadelphia). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Short rotation silviculture of fast growing species such as hybrid poplar trees promises to yield large amounts of cellulosic biomass from marginal land or land otherwise unsuitable for normal agricultural production. From trials performed in Pennsylvania with hybrid poplars, it appears possible to obtain yields up to 9 dry tons/acre/year with yields after the first harvest as high as 15 dry tons/acre/year. These yields were obtained with selected clones grown from cuttings at the rate of 6200 trees per acre, harvested after four years and then every 2 to 3 years thereafter. These trees have many advantages. They require little or no fertilizer; little agricultural activity, except for harvesting and insecticide applications; no replanting because they resprout from the cut stump; and they minimize erosion because the roots stay in place. Such cellulosic biomass can be used for heat production by direct combustion, or gasification, employing either wood chips or densified pellets. When processed through a suitable industrial facility, this biomass could generate liquid fuels (alcohol), high value chemical feed stocks from the lignin, high quality animal feed from the leafy portions, and numerous other high value and energy conserving materials. Consequently, it can be projected that this wood biomass has a potential raw value of greater than $20/ton on a dry basis, thus producing, after costs, an income of over $200/acre/year from marginal land. This value promises to rise in parallel with the cost of energy. New technologies currently under development could make such material even more valuable than is presently predicted.

43982 (CONF-8211193—, pp 1-5) **Forest service energy program and its potential.** Hornick, J.R. (USDA - Forest Service, Washington, DC). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

A forestry perspective on fuelwood is presented. Environmental problems possible in erosion, nutrients, wildlife, and crop tree damage are discussed.

43983 (CONF-8211193—, pp 6-13) **Energy properties of wood.** Zerbe, J.I. (Forest Products Lab., Madison, WI). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

Wood is an alternative source of energy that will not displace fossil, nuclear or other renewable sources. However, it can provide 7-10% of our total energy needs. There is some question about current usage of wood fuels, but DOE has recently published some definitive figures. For 1981, these are 0.820 quad in residential applications, 0.016 quad commercial, 1.374 quad industrial and 0.001 quad utility. This amounts to 2.211 quads and is in line with Forest Service estimates. There are various ways in which wood might be used for energy purposes. Direct burning of wood is simple and efficient, and is the way in which almost all energy from wood is produced now. Minor amounts of wood are converted to improved fuels by charcoaling and densification processes. Pyrolysis, gasification, and liquefaction processes are promising for the future. Improvements for using wood in direct burning applications, conversion of wood to alcohol and petrochemical substitutes, conservation of energy in processing forest products, and uses of wood in solar energy applications is discussed.

43984 (CONF-8211193—, pp 62-66) **Potential biological productivity of wood lots and suggested management practices.** Brand, G.J. (North Central Forest Experiment Station, St. Paul, MN). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

Two examples are presented to illustrate the use of a tool for estimating future yields of firewood and fuelwood. The tool used is a tree growth model that comes in two versions; STEMS (used on a large computer) and TWIGS (used on a microcomputer). A previously unmanaged 50 year old oak stand managed for sawtimber yields 37 green tons per acre of firewood and fuelwood during 30 years. A second growth northern hardwood stand managed for sawtimber yields 34 green tons per acre of firewood and fuelwood during 30 years. In both cases the residual stand contains high quality trees of desirable species. Other stands and management objectives can also be examined with this tool.

43985 (CONF-8211193—, pp 67-81) **Economic benefits from fuelwood harvesting in forest management.** Field, D.B. (Univ. of Maine, Orono). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

Demands for fuelwood offer a great, but probably temporary opportunity for improving the commercial quality of eastern hardwood forests. Dramatic increases in both industrial and domestic use of wood fuels have occurred since the Arab oil embargo of 1973. The forest industry will probably continue, as it always has, in rural areas where wood is abundant and cheap. But, the stakes are so high for the development of an inexpensive, abundant, convenient substitute for petroleum that such a technological breakthrough is very likely to occur. Opportunities for fuelwood demand

to enhance forest management are clouded by some dangers. Wood processors are concerned over competition for their raw materials. Many with an interest in timber supply fear that widespread fuelwood demand may result in generalized resource depletion and unnecessary destruction of high-quality growing stock. Full-tree harvesting may reduce site quality and efforts to extract thinnings may damage residual stems. There is concern over the effects of fuelwood harvesting on wildlife. Some of the dangers in fuelwood harvesting are discussed.

43986 (CONF-8211193—, pp 82-88) **Establishment and management of energy plantations.** Dickmann, D.I. (Michigan State Univ., East Lansing). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

For those who burn wood as fuel, an alternative to the purchase of fuelwood exists: it is possible to plant and grow cordwood. In 10 to 20 years, perhaps less, a plantation of fast-growing trees can produce enough wood to fully or partially meet the annual needs of a wood stove or furnace. Plantations should be established on the best land available; well-drained, medium-textured soils are best. Sites should be prepared as they are for an agricultural crop. On open land spraying with a herbicide, such as glyphosate, to kill existing weed cover followed by plowing and discing is an excellent strategy. However, a completely no-till approach is an option, provided the soil is not highly compacted or if root growth is not restricted by impervious layers. The major objectives of site preparation should be to fit the land for planting and control competing vegetation; if either of these objectives fail to be met, the plantation will not perform as anticipated.

43987 (CONF-8211193—, pp 89-92) **Managing natural stands for biomass.** Young, H.E. (James W. Sewall Co., Old-town, ME). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

Managing natural stands for biomass is nothing more than the application of the Complete Forest Concept to the sound principles of forest management that have been developed over several hundred years. The strategy of management remains unchanged by the tactics that will be altered because much more intensive forest management becomes possible within the Complete Forest Concept provided that there are markets for all forest products. Biomass is usually expressed as the fresh or dry weight per plant component (leaves, branches, stem and stump-root system). Weight is most commonly used because of the odd shapes and sizes of roots and branches as well as the leaves and needles and because weight is a convenient unit for all components of woody shrub and tree species. All of the components of woody shrub and tree species are biomass with the hierarchy of component value subject to frequent and rapid change. Today many sawmills break even on the manufacture and sale of boards and make their profit on the chips sold to pulpmills. The money collected by the sale of biomass is as valuable as the money obtained by the sale of veneer and boards and in the long run there may be more of the former than the latter. I do not advocate the management of forest tracts, small or large, for a single product. Foresters are encouraged to grow the best possible forest for their locality. By careful sorting, all possible products will be obtained with a significant amount of it available for energy markets.

43988 (CONF-8211193—, pp 94-97) **Case history of biomass harvesting.** Berti, R.J. (Foreco, Rumney, NH). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

Approximately 260 acres of forest land have been harvested in the biomass project. The timber types, age classes, and topographical conditions are varied and information is complete on 242 acres of operations. Although different topographical and forest stands are necessary to complete the project, information and experience has been gathered and the conclusions are discussed.

43989 (CONF-8211193—, pp 104-105) **Kubota - Igland system.** Hawkes, E.G. (Woodland Fuels, Inc., Woodstock, VT). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

In cooperation with the US Forest Service and the Vermont Department of Forests and Parks, Woodland Fuels, Inc. has designed and built a relatively low cost, standing skyline cable yarding system. This system which is being tested and demonstrated on various sites around the state is designed primarily to thin pole size hardwood stands on all types of terrain with minimal site and residual stand damage. The basic system components are a 34 hp. Kubota, 4-w-d tractor, an Igland double drum winch, a 17 foot tower, a locking skyline carriage, cables and rigging hardware. This system will handle turns up to a cord in size, but 1/3 cord is optimum for ease and speed of operation. Research of the skyline is 1000 feet with lateral yarding usually reaching out to 100 feet each side of the skyline. This system has shown the potential for small skyline cable systems to economically remove thinnings with virtually no disturbance.

43990 (CONF-8211193—, pp 106-109) **Wildlife and other multiple use considerations.** Gill, J.D. (Northeastern Forest Experiment Station, Morgantown, WV). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

When people harvest fuelwood they often remove material that wildlife uses for obtaining and conserving energy and for other benefits. Although foresters know this, they commonly describe potential fuelwood as if it were otherwise useless. Aesthetically, fuelwood harvesting tends to improve visual quality, as conventionally perceived. However, that perception favors reduced ecological diversity, particularly along roads and trails where most of the personal-use harvesting occurs. Concerns about security focused on preventing accidents among amateur wood cutters, theft of wood, and vandalism. The soil/nutrient/water concerns were mainly limited to industrial-scale harvests such as whole-tree removals. Wildlife concerns generally were about reduced habitat diversity within more so than among stands. In sum, these concerns outline needs for educational effort and enforcement of rules (aesthetics and security) and for research and improved guidelines (soils/nutrients/water and wildlife).

43991 (CONF-8211193—, pp 110-114) **Forest management and marketing cooperative: are they a viable alternative?.** Brusila, B. (Forest Products Marketing and Management Cooperative, Dover-Foxcroft, ME). 1982. NTIS, PC A09/MF A01. File Number DE85000687.

From Fuelwood management and utilization seminar; East Lansing, MI, USA (9 Nov 1982).

In Maine, approximately one half of the woodland is owned by the rather undefinable NIPF (Nonindustrial Private Forest) landowner. With increasing population pressures and demands on our forest resources, people are taking a harder look at increasing the productivity of these nonindustrial private forests. Forestry cooperatives are one means towards that end, as are landowner associations. These are a part of the whole informational-educational effort which is basic in trying to do anything with landowners. They must be motivated and interested.

43992 (CONF-8506172—1) **Economic evaluation of Short Rotation Intensive Culture energy plantations.** Perlack, R.D.; Das, S.; Ranney, J.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016374.

From 7. Southern Forest biomass workshop; Gainesville, FL, USA (11 Jun 1985).

The evaluation of the economics of a representative Short Rotation Intensive Culture (SRIC) energy plantation is demonstrated in this paper using a microcomputer-based cost simulation model. The model is briefly described and then it is used to conduct sensitivity analyses on the rotation age, plantation costs, and first and coppice rotation productivity. By specifying interval esti-

mates for uncertain activities the model is used to conduct an expedient risk analysis.

43993 **(CRN-CPR—84-02) Application of laser annealing for polycrystalline silicon solar cell processing.** Courcelle, E. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). Feb 1984. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750555.

Two new junction fabrication processes have been used to elaborate solar cells from large grained polycrystalline silicon. The processes are whether laser induced diffusion or implantation without mass separation (ion incrustation) followed by laser annealing. The bulk is heated very little: it was shown that a thermal annealing significantly degrades the polycrystalline materials used here. Some hydrogen passivation experiments have been performed, with hydrogen or hydrogen compounds being implanted in order to improve the conversion efficiency of polycrystalline silicon solar cells. A localised photoresponse experiment has been developed in order to evaluate the different treatments carried out on polycrystalline silicon.

43994 **(CRN-CPR—84-04) Impurities in silicon by pulse laser induced diffusion: a new method of superficial doping. Application to the realisation of photopiles.** Fogarassy, E. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1984. 261p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85752387.

The aim of this work is to analyse the behavior of impurities incorporated in silicon by laser induced diffusion. This original doping technique consists to deposit on the surface of a monocristalline Si substrate, a thin film of a dopant or a compound containing this dopant, which diffuses in the melting zone induced by the laser treatment. As a result of the irradiation, the substitutional solubility of the dopant is higher than after classical thermal treatment and its distribution profile is sharp. These results are interpreted on the basis of a segregation effect of the dopant atoms at liquid solid surface during the fast regrowth of the melting zone. These heavy doped layers present very interesting electrical properties which have been applied to the fabrication of high efficiency silicon solar cell.

43995 **(DOE/AF/20001—T1) AQUAHOL: a developmental project. Technical progress report, November 1980-July 1981.** Woodbridge, D.D.; Doering, W.C. (Palm Beach Junior Coll. Foundation, Inc., Lake Worth, FL (USA)). Jul 1981. Contract FG01-81AF20001. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85008825.

During the period from November 1980 through July 1981, the potential of commercially growing cattails for use in making alcohol was studied by the Palm Beach Junior College and Sub-Grantee, Lantana Boatyard Inc. and a contractor, Gressinger and Sons Inc. The study involved the conversion of wild cattail rhizomes, roots, and nodal tissues to alcohol, the design of a basic harvesting mechanism, and the planting and growth of cattails on a commercial size acreage. Results of the study show that, alcohol can be made from cattails in greater quantities per acre than other considered crops; one of the factors with using cattails as a commercial crop is the requirement for the development of specialized harvesting equipment; cattails will provide an excellent crop for marginal farm land that is often flooded or swampy and too wet for other crops. 71 refs., 46 figs., 1 tab.

43996 **(DOE/ER/01198—2052) Spray pyrolysis processing and properties of thin film photovoltaic materials.** Albin, D.S. (Illinois Univ., Urbana (USA). Graduate Coll.). Aug 1985. Contract AC02-76ER01198. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016725.

Thin film deposition equipment for the spray pyrolysis of the photovoltaic materials CdS and $CuInS_2$ was designed and built. Techniques for the fabrication and analysis of these films were developed. From growth rate measurements and compositional, microstructural, and x-ray analysis, a possible nucleation and growth model was developed. Apparent film growth at low deposition temperatures was mass transfer limited by the solution spray rate where inefficient surface pyrolysis resulted in erroneous indications of high growth. With increasing temperature and more efficient pyrolysis, the growth rate decreased with less impurity incorporation and larger grain sizes resulting. The results of our findings as well as those reported in the literature were explained in terms of this model. High deposition rates of up to 3200 A/min at a spray solution rate of 2 ml/min and lower substrate temperatures while maintaining reasonable film quality as determined by resistivity, x-ray diffraction, and surface profile measurements were obtained using high concentrated excess thiourea solutions. The use of excess cadmium solutions was not found to be beneficial except at very high temperatures. Film uniformity as indicated by resistivity and thickness measurements was relatively poor due to the use of a fixed nozzle system although respectable resistivity values of as low as 1.7 and 1.3 ohm cm for CdS and $CuInS_2$ films were measured. Optical measurements indicated a direct band gap for sprayed CdS films of 2.45 eV with measured transmissions of up to 70% for 1 micron thick films.

43997 **(DOE/JPL/956679—84) MOD silver metallization for photovoltaics. Final technical report, December 1, 1983-May 31, 1985.** Vest, G.M.; Vest, R.W. (Purdue Univ., Lafayette, IN (USA)). 1 Jul 1985. Contract NAS-7-100-956679. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85015758.

This was a study to investigate the feasibility of utilizing metallo-organic decomposition (MOD) silver inks for front contact metallization of solar cells. Generic synthesis procedures were developed for all metallo-organic compounds investigated. Silver neodecanoate was found to be the most suitable silver metallo-organic compound for use in thick film inks. Benzene was the most suitable solvent investigated for silver neodecanoate, and tetrahydrofuran was a less desirable alternative. A combination of neodecanoic acid and butyl carbitol acetate imparted suitable rheology to silver MOD inks for screen printing. A permanent binding agent was found to be necessary to obtain reproducible, long term adhesion. Bismuth 2-ethylhexanoate, which decomposes to bismuth oxide upon firing, was shown to be suitable for this purpose. Both platinum 2-ethylhexanoate and bismuth 2-ethylhexanoate, which respectively decompose to platinum and bismuth oxide, were suitable for imparting solder leach resistance to the silver films. Ink SC-10Y, which produces fired films of theoretical metallic composition 99 w/o Ag-1 w/o Bi, was the most suitable of all inks developed for solar cell front contact metallization. The contacts fabricated with it exhibited long term adhesion, excellent solderability and solder leach resistance, and a dense microstructure. The preferred firing sequence for ink SC-10Y involves a 70 minute cycle with a maximum temperature of 292°C. The combination of HF cleaning and the preferred firing sequence produced a high resistance back contact with certain lots of solar cells. This observation requires that changes be made either in the metallurgy of the back contact or in the processing of the MOD inks.

43998 **(DP-MS—85-62) Remote sensing forest biomass for loblolly pine using high resolution airborne sensor data.** Jensen, J.R.; Hodgson, M.E.; Mackey, H.E. Jr. (South Carolina Univ., Columbia (USA). Dept. of Geography; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 30p. (CONF-8506167—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017058.

From Forest land applications symposium; Seattle, WA, USA (25 Jun 1985).

The amount and spatial distribution of vegetation are important parameters useful in agriculture, forestry, wetland, and hydrologic research. Such data may be collected in situ by harvesting a sample of the vegetation and determining the amount of biological matter (biomass). This approach provides single point estimates which are expensive to collect and difficult to extend through space in order to map the geographic distribution of biomass. It is, however, possible in certain instances to obtain acceptable estimates of biomass by analyzing remotely sensed data. This paper describes the analysis of very high resolution, remotely sensed data of loblolly pine (Pinus taeda) in a controlled experiment in South Carolina. Loblolly pine was examined because it represents over 70% of the commercial forest in the southeastern United States. Pine plots located on both sandy and clay soils were treated with sewage sludge

to provide 0, 445, or 890 kg (approximately 0, 990, or 1980 lb) of nitrogen per hectare. Indices of biomass from remote sensing data were significantly correlated with in situ biomass measurements made in each plot. A ratio of infrared (0.9 to 1.1 μm) and red (0.65 to 0.70 μm) channels yielded the best correlation between the remote sensing data and the in situ biomass measurements. In addition, remote sensing provided a quantitative map of the spatial distribution of the biomass in the forest plots. The indices of biomass from the remote sensing data were not sensitive to differences in soil type (sandy or clay). 31 refs., 3 figs., 5 tabs.

43999 (EUR—8206-EN) Fundamental study of recombination in solar cells with highly doped substrates. Overstraeten, R. van; Mertens, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1982. 83p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The main objective of this project is a better understanding of the limitations that influence the efficiency of silicon junction solar cells. In particular, attention has been focused onto the mechanisms that determine the open circuit voltage. The first chapter of this report describe the heavy doping effects in silicon. The high doping effects strongly in influence the behavior of devices that are based on the injection of minority carriers. The bandgap narrowing effect causes an increased minority carrier charge while the lower values of the minority carrier lifetime gives rise to an enhanced recombination current. Consequently, both AC and DC performance of bipolar devices, as predicted by a simple model that neglects high doping effects, will be overestimated. Examples of devices, strongly influenced by heavy doping effects, are a bipolar transistor, an integrated injection logic gate and a solar cell. A second chapter in this report deals with a cell processing sequence that can achieve very high efficiencies. First, a chemical vapour deposition technique for doped oxides has been introduced for the fabrication of n^+pp^+ and p^+nn^+ silicon solar cells. Without optimisation of the process, a cell efficiency of 14% is currently obtained. The limiting factors are discussed.

44000 (FRNC-TH—1577) Contribution to the study of irradiation defects induced in n-type GaAs. Stievenard, D. (Lille Univ., 59 - Valenciennes (France). Centre Universitaire). 1982. 141p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85750552.

The defects induced by electron irradiation at room temperature and high temperature were investigated in order to study the heating of irradiation damaged solar cells and also the feasibility of semi-insulating substrates. The defects were characterized by deep level transient spectrometry. Three traps E3, E4, E5 were characterized after irradiation at room temperature and annealing. At temperature above 200°C, three other traps P1, P2, P3 were observed, the capture cross section of which was determined. Seven new traps were observed after irradiation at high temperature. Their concentration and introduction rate were studied as a function of both temperature and irradiation doses.

44001 (FRNC-TH—1910) Contribution to the preparation of high efficiency gallium arsenide solar cells by vapour phase epitaxy with organometallic compounds. Kiel, G. (Toulouse-3 Univ., 31 (France)). 1982. 145p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751278.

This paper deals with the preparation the study and the characterization of gallium arsenide films epitaxied by vapour phase growth with organometallic compounds under reduced pressure. Characteristics of solar cells with thin front face homojunctions and rear field using these thin films are studied.

44002 (FRNC-TH—2010) Study of liquid silicium coating by a molten salt. Application to photovoltaic silicium ingot fabrication. Minster, O. (Institut National Polytechnique, 38 - Grenoble (France)). Dec 1984. 136p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752375.

Study of the behaviour of immiscible liquids towards crucibles (in order to avoid fissuration of the silicium bar, clutter nucleation or matter deperdition): liquid silicium protection test against any reactors with the graphite crucible by complete coating in an appropriate bath (binary salt CaF_2-MgF_2), analysis of the characteristics of the process (profile of the drop, needle development) and analysis of the protection during solidification (nucleation) and separation from the crucible (adhesion). Examination of the feasibility of this system when casting the bars in parallelepipedal shape as required by the photovoltaic silicium industry.

44003 (JPL—5101-66) Low-Cost Solar Array Project. Ninth project integration meeting handout, April 12-13, 1978. (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1978. Contract AI01-76ET20356. 93p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85015766.

The status of the JPL Low-Cost Solar Array Project is described in this handout of the 1978 meeting. The report includes the following sections: (1) project analysis and integration; (2) technology development area (silicon material task, large-area silicon sheet task, encapsulation task, and automated array assembly task); (3) engineering area; and (4) operations area. (BCS)

44004 (PB—85-192862/XAB) Mechanism of photosynthetic oxygen evolution: a study of the primary photoreactions and of electron carriers. Mathis, P.; Paillotin, G.; Conjeaud, H.; Rutherford, A.W.; Schenck, C.C. (Commission of the European Communities, Luxembourg). 1984. 62p. (EUR—9274-EN). NTIS, PC E04/MF E04.

See also PB82-146606.

The process of oxygen evolution in green plants is realized by the so-called Photosystem-II, a complex ensemble of pigments, of electron carriers and lipo-proteins, whose composition and structure are poorly known. The research aimed at increasing the authors knowledge on this complex (its chemical composition, its structure, its reaction mechanisms), by the way of spectroscopic and physico-chemical studies on the intact chloroplast on chloroplast particles. A detailed analysis of this electron transfer has been made.

44005 (PB—85-195188/XAB) Photosynthetic water oxidation by green plants: on the role of protons. Junge, W.; Foerster, V. (Commission of the European Communities, Luxembourg). 1984. 65p. (EUR—9331-EN). NTIS, PC E04/MF E04.

This report is devoted to the protolytic reactions which accompany electron abstraction from water and are expected to give a clue to the intermediate stages of stepwise catalysis. Broken chloroplasts from higher plants were studied. A spectrophotometric technique to measure proton release into the narrow (20nm) inner phase of thylakoids was perfected for very high sensitivity (.001 pH units) at high time resolution (1 microsecond) and with regard to spatial resolution. Starting from the lowest oxidation state of the manganese protein a stoichiometric pattern of proton release per electron abstracted was observed. The authors furthermore determined the stoichiometry and the kinetics of proton release in the presence of hydroxylamine. Based on this information the authors define restrictions for possible mechanisms of water oxidation. However, the exact mechanism still remains obscure, mainly because of insufficient knowledge on the state of manganese in the enzyme. Further work will be directed to probe the enzyme with several different water analogues.

44008 (PB—85-197028/XAB) Identifying aboveground wood fiber potentials in New York state. Forest Service resource bulletin. Wharton, E.H. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1985. 31p. NTIS, PC A03/MF A01.

This is a statistical analytical report on the biomass resources of New York. The study was conducted in conjunction with the third forest survey of New York by the USDA Forest Service. Statistical findings are based on new 10-point-variable radius plots, a canvas of wood manufacturers, timber-utilization plots, and a mail canvass of private, commercial forest-land owners - all conducted in 1978 and 1979. The report presents total aboveground biomass supplies, the use of biomass in the state for forest products, and sources of wood from residues and standing trees that can be used to improve wood-fiber recovery.

44007 **(SAND—84-7022) Installation of a modular building block photovoltaic concentrator array field.** Sanders, J.A.; Cass, D.C.; Broadbent, S. (Intersol Power Corp., Lakewood, CO (USA)). Jun 1985. Contract AC04-76DP00789. 81p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016032.

A building block array field nominally rated at 25 kW has been installed in Albuquerque, New Mexico. The building block is a single source electrical circuit of six center pedestal two-axis tracking arrays connected in parallel and having a nominal operating voltage of 420 volts DC. Each array contains 60 point-focusing Fresnel lens photovoltaic concentrator modules connected in series for a nominal power output of 4.2 kW per array. The structural design uses a center pedestal two-axis cantilevered support tube with a closed loop sun sensor electronic control system. A master control provides manual override of the array field. The installation was accomplished without difficulty and demonstrated the ease of turnkey building block installation. The costs of 1 MW size fields is estimated to be $6.99 per watt installed based on the building block installation.

44008 **(SAND—85-7001) Development and fabrication of photovoltaic concentrator modules for a point-focus Fresnel lens array.** Broadbent, S.; Sanders, J.A. (Intersol Power Corp., Lakewood, CO (USA)). Jun 1985. Contract AC04-76DP00789. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017322.

Design of the second generation photovoltaic concentrator module originally developed by Martin Marietta under Contract 46-3018 was improved. Module efficiency was improved from 14.4% to 15.5% and numerous detailed design enhancements were incorporated to facilitate fabrication and improve cost effectiveness. Sixty modules were manufactured to populate the second generation structure already installed at the Sandia National Laboratories test site in Albuquerque, NM, plus 10 spares and test units. To further improve the life capability and facilitate installation of the design, additional design development was authorized for (1) cell interconnect research to provide greater stress relief at the cell-interconncet and substrate-interconnect interfaces; and (2) incorporation of a reflective secondary to relieve tracking accuracy and initial alignment accuracy requirements.

44009 (SERI/CP—211-2682, pp 13-20) **Research on amorphous silicon and related alloys at the University of Utah.** Taylor, P.C. (Univ. of Utah, Salt Lake City). Mar 1985. NTIS, PC A14/MF A01. File Number DE85008794. (CONF-8503106—).

From Amorphous silicon subcontractors annual review meeting; Washington, DC, USA (21 Mar 1985).

Research covers four major topics: (1) the use of photoluminescence (PL) to probe optical absorption below the gap in thin films; (2) PL and absorption in alloy systems such as a-Si/sub x/Ge/sub 1-x/:H; (3) nuclear magnetic resonance (NMR) studies of bonding and H_2 diffusion in thin films; and (4) measurements of optically-induced, metastable electron spin resonance (ESR) in thin films. Absorption coefficients below 10 cm^{-1} were measured using only optical methods. Time resolved and cw (PL) measurements in a-Si/sub 1-x/Ge/sub x/:H alloys have been performed for $0 \leq x \leq 0.52$. For x approximately <0.4 the samples exhibit a universal tail on the low-energy side of the PL spectra. The PL efficiency in this tail region is remarkably independent of GE content. The third topic involves NMR of films on substrates. Facilities were developed for examining NMR of hydrogen in a-Si:H thin films which remain on the substrates. Comparisons of samples removed from the substrates with films on substrates indicate that the major features of the NMR lineshapes are unchanged by removing the films from the substrate. The optically induced increase in hydrogenated amorphous silicon (a-Si:H) under prolonged irradiation (up to 10^5 min.) at 300K with a tungsten light source was studied for various light intensities using films on quartz substrates. At a light intensity of $\sim$ 1.3 W cm^{-2}, the growth of the ESR intensity of 3 μm thick a-Si:H films is characterized by a rapid increase during the first 20 min of irradiation during which time the spin density (n/sub s/) increases from $\sim 10^{15}$ cm^{-3} to $\sim 10^{16}$ cm^{-3}.

44010 **(SERI/CP—231-2700) Aquatic Species Program review: proceedings of principal investigators meeting.** (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 353p. (CONF-8503158—). NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85012137.

From SERI aquatic species review - principal investigators meeting; Golden, CO, USA (20 Mar 1985).

The purpose of the Aquatic Species Program is to improve the productivity, conversion to fuels, and cost efficiency of aquatic plant culture technologies. The emphasis of the program is on developing a mass culture technology for cultivating oil-yielding microalgae in the American southwest. A technical and economic analysis indicated that such a concept would be feasible if (1) lipid yields from microalgae are improved, (2) there is sufficient saline water for large-scale development, and (3) microalgal lipids can be economically converted to conventional fuels. It was determined that fuels from microalgal lipids presented better options than converting the microalgal biomass to either alcohols or methane. All lipids can potentially be catalytically converted to gasoline, or the fatty acids can be converted to substitute diesel fuels. The Southwest has the necessary low, flat, underutilized lands, and carbon dioxide is available from either natural deposits or flue gas from industrial plants. The amount of saline water available will probably determine how much fuel can be produced from aquatic species, and this question should be answered during 1985. The largest constraint of this technology is the economical production of an oil-rich microalgal feedstock. The agenda for the review was divided into four sections: species selection and characterization, applied physiological studies, outdoor mass cultivation, and systems design and analysis. Papers from these presentations are included in these proceedings. Program advances were reported in the areas of species collection and selection, modulated light physiology, mass culture yields, harvesting of microalgae, mass culture facility design and analysis, and assessments on fuel options from microalgae. Separate abstracts have been prepared for each paper for inclusion in the Energy Data Base.

44011 **(SERI/PR—212-2601) Solid State Photovoltaic Research Branch annual report, FY 1984.** (Solar Energy Research Inst., Golden, CO (USA)). Apr 1985. Contract AC02-83CH10093. 217p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85008812.

This report summarizes the progress of the Solid State Photovoltaics Research Branch of the Solar Energy Research Institute from 1 October 1983 through 30 September 1984. The six technical sections of the report cover these main areas of SERI's in-house research: Semiconductor Crystal Growth, Amorphous Silicon Research, Polycrystalline Thin Films, III-V High-Efficiency Photovoltaic Cells, Solid State Theory, and Semiconductor Purification Research. The task in each section was to explain the purpose and major accomplishments of the work in the context of the US Department of Energy's Photovoltaic Research Program plan. Lists of current, relevant publications are also included.

44012 **(SERI/STR—211-2516) Development of stable high efficiency polycrystalline thin-film solar cells based on $CuInSe_2$. Final report, 16 March 1983-15 March 1984.** Birkmire, R.W.; Hall, R.B.; Phillips, J.E.; Meakin, J.D. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Mar 1985. Contract AC02-83CH10093. 300p. NTIS, PC A13/MF A01; GPO Dep. File Number DE85000517.

A two-junction, monolithic, optically and electrically coupled solar cell has been designed and a successful prototype produced. Each junction is a thin-film polycrystalline cell, namely, $CuInSe_2$/(CdZn)S and CdTe/(CdZn)S. All active semi-conductor layers are produced by physical vapor deposition. During this contract year, a procedure for producing thin-film p-type CdTe by physical vapor deposition and a usable transparent interconnect for the tandem cell were developed.

44013 **(SERI/TP—211-2733) Terrestrial photovoltaic research and development.** Zweibel, K.; Surek, T. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 8p. (CONF-850808—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012133.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

Developing practical photovoltaic (PV) devices for the conversion of sunlight into electricity on earth requires R & D to build on the knowledge acquired during the successful space-PV development program. It also requires new generations of materials and structures specifically designed for the terrestrial environment. Silicon ribbon technology has had marked success as an adaption of the single-crystal and polycrystalline silicon technologies. A new generation of terrestrial PV technologies is emerging based on single- and multi-junction thin-film flat plate and concentrator systems. These are the technologies being emphasized in the research program conducted by the Solar Energy Research Institute as part of the US Department of Energy's National Photovoltaics Program. This paper examines the status of silicon ribbons, thin films, and concentrators, as well as their application in various potentially high-performance, cost-competitive structures.

44014 **(SERI/TP—213-2689) Structural and electrical characterization of polycrystalline semiconductor materials.** Matson, R.J.; Tsuo, Y.S. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1985. Contract AC02-83CH10093. 8p. (CONF-850421—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012166.

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Secondary electron imaging, electron channeling and electron-beam-induced current (EBIC) are used alternately in a scanning electron microscope to characterize and correlate the morphology, crystallographic orientation, and electronic quality (types and spatial distribution of defects) of individual grains in polycrystalline semiconductor samples. The technique is discussed in some detail, and a number of applications and results in the study of edge-supported-pulling (ESP) silicon sheet and low-angle silicon sheet (LASS) materials are reported.

44015 **(SERI/TP—216-2787) Review of photovoltaic research in the US.** McConnell, R.D. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1985. Contract AC02-83CH10093. 5p. (CONF-850858—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012165.

From US/India binational symposium on solar energy research and applications; Roorkee, India (5 Aug 1985).

This paper describes US research efforts to develop new generations of photovoltaic technologies having the potential for lower cost and better performance than the older generations of crystalline silicon technologies. The newer generations consist primarily of single and multijunction thin film devices destined for either flat plate or concentrator photovoltaic systems. The principal sponsors for the research are the US Department of Energy, US photovoltaic companies, the Electric Power Research Institute, and those US government agencies interested in the use of photovoltaics in space. The paper concludes with a description of future research activities in the areas of amorphous silicon, polycrystalline thin films, high efficiency concepts, and fundamental research.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 44007

44016 (CONF-801197—, pp 161-167) **Photovoltaics for irrigation and fertilizer production.** Rein, B. (Univ. of Nebraska). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The world's largest solar cell-powered system for agriculture has been providing electrical power since the summer of 1977 for irrigation, crop drying, and nitrogen fertilizer production at the University of Nebraska's field laboratory near Mead, Nebraska. The output from the 25 kW peak photovoltaic array is used to run a 15 kW irrigation pumping plant capable of pumping 1200 gpm - 10 hours a day from a reservoir through an automatic-gated pipe irrigation system for 80 acres of corn. During the fall and early spring, power from the photovoltaic array is used to dry 12,000 bushels of corn in two grain bins, each with a five horsepower fan for natural air drying. In the winter months, and any other time power from the array is available, nitrogen fertilizer is produced by a electric arc process from air, water, and limestone. The 3 kW nitrogen fertilizer-genertor produces liquid calcium nitrate fertilizer that is injected in the irrigation system in the summer. 2 figs.

44017 (CONF-801197—, pp 168-172) **Management of solar cell power for irrigation.** Sullivan, N.W.; Thompson, T.L.; Fischbach, P.E.; Hopkinson, R.F. 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The direct current output of a 25 kW peak output 520 m^2 photovoltaic array was used to run an irrigation pump for a 32 ha cornfield. The battery storage requirements for different methods of pump operation were compared. When 30 kW.h of battery storage was available, over 95% of the power produced by the array could be utilized by the irrigation pumping plant operating at full load. The step (variable) speed operation of the irrigation pump required 2 to 20 kW.h of power storage depending on whether the day was clear or cloudy. However, when the power storage was reduced, the step load operation could use only 60% of the power produced by the array. Of the remaining 40%, 33% was dissipated in the power dump and 7% was lost in reduced system operating efficiencies. 9 figs.

44018 **Budget overruns threaten first solar 100 MWe photovoltaic project.** Anderson, M.W.; Thorpe, D.; Collier, D. (Sacramento Municipal Utility District, CA). *Modern Power Systems;* 5: No. 6, 19-23(Jul 1985).

The Sacramento, California utility and DOE are jointly sponsoring the Smud photovoltaic (Smudpv) project to design, construct, and demonstrate a 100 MW generating facility and test the environment for future projects. A cost overrun of $3.25 million on a $40 million budget now threatens phase three of the Smud project. Phase one has provided commercial service since August of 1984, with major problems confined to the power conditioning unit and the direct current ground detection system. Procurement and construction contracts for phase two are on schedule, with a three per cent budget overrun expected. Bids for phase three, however exceeded the budgetary limit. Smud represents the first time that a project of this type has placed control of every aspect into the hands of the utility, the end-user with a better understanding of the constraints. 6 figures, 7 tables.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 44061, 44091, 44092, 44095, 44096

44019 **(PB—85-186211/XAB) Southwest region solar pond study for three sites: Tularosa Basin, Malaga Bend, and Canadian River.** Boegli, W.J.; Dahl, M.M.; Remmers, H.E. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Aug 1984. 75p. (REC-ERC—83-17). NTIS, PC A04/MF A01.

In the study, the Bureau of Reclamation investigated the technical and economic feasibility of using solar salt-gradient ponds to generate power and to produce freshwater in Bureau projects at three sites--the Canadian River at Logan, New Mexico; Malaga Bend on the Pecos River near Carlsbad, New Mexico; and the Tularosa Basin in the vicinity of Alamogordo, New Mexico. The ponds would be used to generate electric power that could be integrated with the Bureau's power grid or used in combination with thermal energy from the ponds to power commercially available desalination systems to produce freshwater. Results of the economic analysis, which concentrated primarily on the Tularosa Basin site, showed that solar-pond-generated intermediate load power would cost between 62 and 90 mills/kWh and between 52 and 83 mills/kWh for baseload power. This results in benefit-cost ratios of approximately 2.0 and 1.3 for intermediate and baseload, respectively, when compared to similar facilities powered by fossil fuels. The cost savings are even more pronounced when comparing the two

(solar versus fossil fuel) as a source of power for conventional distillation and membrane-type desalination systems.

44020 (SAND—84-8190) Analysis and design of the Volumetric Air Heating Receiver. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC04-76DR00789. 185p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85016092.

Pacific Northwest Laboratory (PNL) has performed a preconceptual design and cost evaluation of a volumetric receiver, a novel approach for producing high temperature air for process heat applications. In this central receiver concept, solar energy is concentrated by a field of heliostats onto the receiver which is located on top of a tower. The concentrated flux is intercepted throughout a matrix of fins or fibers rather than on the surface of the receiver, hence the reference to "volumetric" absorption. An exterior row of reflecting fins which act as a "light valve" to allow energy to enter the receiver but inhibit thermal radiation and reflection from leaving the receiver is a critical feature of the concept. Ambient air is drawn in through the absorbing array, cooling the receiver and heating the air. The air is then drawn through downcomer piping to heat-exchangers. Through the design evolution of this receiver, several qualitative advantages that made the concept attractive were lost. What had originally been envisioned to be a compact and simple air receiver design turned out to be much larger and more complicated when the preliminary engineering design was completed. A much lower efficiency was also predicted at the end of the study. Due to the complexity of the design, the lower efficiency, and a list of major technical uncertainties discussed in this report, PNL has recommended that the volumetric receiver project be discontinued.

44021 (SAND—85-8180) Numerical simulation of buoyant turbulent flow. Final report. Humphrey, J.A.C.; Sherman, F.S.; To, W.M. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). Aug 1985. Contract AC04-76DR00789. 189p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85017392.

Two models have been developed for predicting low Reynolds number turbulent flows in the free and mixed convection regimes. One, the KEM model, is based on the notion of eddy diffusivities for momentum and heat. The other, the ASM model, is based on algebraic relations derived for the anisotropic turbulent fluxes by suitable truncation of the parent transport equations. Both formulations apply to variable property flows with high overheat ratios. A comparison between measurements and predictions for the case of the vertical plate shows that both models yield fairly accurate results for the mean flow and heat transfer. As a result, only the simpler of the two models, the KEM, was used to predict the cavity flows. Predictions for the case of the vertical flat plate show excellent agreement with measurements of mean velocity, temperature and Nusselt number. Nearwall results predicted by both models reveal the existence of a 1/3 power-law dependence. Regions of negative buoyant and shear production of turbulence kinetic energy are clearly revealed by the calculations. Calculations of the cavity configuration were performed for the free and mixed flow conditions. Fairly good agreement is obtained between measurements and predictions of the velocity and temperature fields. Many of the complex characteristics of heated cavity flows, revealed experimentally, are resolved numerically. Although differing in absolute value, calculations of the cavity Nusselt number show trends which are in accord with the measurements. Thus, in the free convection regime it is shown that when the cavity is tilted forwards stable stratification of fluid dampens the turbulence fluctuations which works to reduce heat transfer.

44022 (SAND—85-8225) 10 MWe Solar Thermal Central Receiver Pilot Plant mirror module corrosion, torque tube damage, and mirror reflectance survey, July 1984. Decker, E.V.; Lopez, C.W.; Mavis, C.L.; Noring, J.E. (Southern California Edison Co., Rosemead (USA); Sandia National Labs., Livermore, CA (USA)). Jul 1985. Contract AC04-76DR00789. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016226.

This report documents the results of the 1984 survey of mirror module corrosion, mirror reflective area, and torque tube damage at the 10 MWe Solar Thermal Central Receiver Pilot Plant. As of July 1984, 0.029% of the total reflective area of the heliostat field was corroded. However, the 1984 growth rate of the corrosion is much less than the 1983 rate: 92% for 1984 compared with 1000% for 1983. In the 1984 survey, the average reflective area for a heliostat was 420.94 square feet compared to the design value of 430.00 square feet. In addition, we determined that the reflective area must be measured after the edge seals are installed, and that ten data points on each module are sufficient to measure the reflectivity. Also, in the survey, we found thirty-five damaged torque tubes; these damages were due to gear box travel beyond the limit switches.

44023 (SERI/TR—255-2553) Corrosion of materials in molten alkali carbonate salt at 900 degrees C. Coyle, R.T.; Thomas, T.M.; Schissel, P. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85012158.

This work was done to assess the compatibility of selected ceramics and alloys with ternary eutectic lithium-sodium-potassium carbonate at 900°C. This salt has been chosen for use in pilot-scale studies of the Direct Absorption Receiver, which will be evaluated at the Advanced Components Test Facility. The candidate containment materials for the receiver were identified in earlier work at SERI and corrosion experiments were conducted on materials immersed in the salt for up to 67 days. Weight change information on the coupons was obtained as a function of exposure time and the corrosion product was examined using SEM and optical microscopy. Metallographic sections of the corroded metal alloys were done to determine metal wastage. It was found that alumina materials formed a protective layer of γ-$LiAlO_2$. A rough estimate of the corrosion rate for Coors AD-998 alumina was 0.06 μm/day. The rate for sapphire was much less than that from AD-998. Inconel 600 displayed the best corrosion resistance of the alloys that were evaluated, less than 3 μm/day. This alloy corroded more slowly in a salt with high oxidation potential and metallography revealed a dense surface oxide under this condition.

1408 Ocean Energy Systems

44024 (ANL/OTEC-EV—3) Far-field model of the regional influence of effluent plumes from ocean thermal energy conversion (OTEC) plants. Wang, D.P. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016981.

Ocean thermal energy conversion (OTEC) plants discharge large volumes of cold water into the upper ocean. A three-dimensional, limited-area model was developed to investigate the regional influence of the far-field effluent plume created by the negatively buoyant discharge. The model was applied to discharges from a 40-MW/sub e/ OTEC plant into coastal waters characterized by various ambient ocean conditions. A typical ambient temperature structure and nutrient distribution, as well as the behavior of the effluent plume itself, were strongly modified by the discharge-induced circulation. Although temperature perturbations in the plume were small, upward entrainment of nutrients from below the thermocline was significant. The regional influence of discharges from an 80-MW/sub e/ OTEC plant, the interactions between the discharges from two adjacent 40-MW/sub e/ OTEC plants, and the effects of coastal boundary and bottom discharge were examined with respect to the regional influence of a 40-MW/sub e/ OTEC plant located in deep water off a coast (base case).

44025 (DOE/SF/00700—T10-Vol.1) Performance assessment of OTEC power systems and thermal power plants. Final report. Volume I. Leidenfrost, W.; Liley, P.E.; McDonald, A.T.; Mudawwar, I.; Pearson, J.T. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). May 1985. Contract AC03-76SF00700. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016501.

The focus of this report is on closed-cycle ocean thermal energy conversion (OTEC) power systems under research at

Purdue University. The working operations of an OTEC power plant are briefly discussed. Methods of improving the performance of OTEC power systems are presented. Brief discussions on the methods of heat exchanger analysis and design are provided, as are the thermophysical properties of the working fluids and seawater. An interactive code capable of analyzing OTEC power system performance is included for use with an IBM personal computer.

44026 **(DOE/SF/00700—T11-Vol.2) Performance assessment of OTEC power systems and thermal power plants. Final report. Volume II. Users' manual for PACC-OTECs.** Leidenfrost, W.; Liley, P.E.; McDonald, A.T.; Mudawwar, I.; Pearson, J.T. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering; Argonne National Lab., Idaho Falls, ID (USA)). May 1985. Contract AC03-76SF00700;AC01-82CE30718. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016792.

Presnted is a user's manual for an interactive computer program that can calculates the simulated performance of closed-cycle ocean thermal energy conversion (OTEC) power systems. The program was developed for use on the IBM personal computer. The program calculate the thermodynamic properties of the working fluids (ammonia and seawater). This manual specifies the power system flow configuration, the input data requirements, and the results calculated by the program. The geometry of the heat exchangers is also described. A listing of the computer program is included.

44027 **(SERI/TP—251-2725) 165-kW open-cycle OTEC experiment.** Shelpuk, B. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 10p. (CONF-850808—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85008818.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

The Solar Energy Research Institute (SERI) is developing a research experiment to establish the feasibility of producing significant amounts of net power from an open-cycle ocean thermal energy conversion (OC-OTEC) system. This experiment is sized at 165 kW/sub e/ gross and is adequate to evaluate turbine performance and system process interactions at a scale that can be extrapolated to projected commercial market entry system sizes of 5 to 15 MW/sub e/.

44028 **(SERI/TP—252-2757) Open-cycle Ocean Thermal Energy Conversion (OTEC): status and potential.** Bharathan, D. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1985. Contract AC02-83CH10093. 11p. (CONF-850858—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012169.

From US/India binational symposium on solar energy research and applications; Roorkee, India (5 Aug 1985).

Tropical oceans with a 20°C or more temperature difference between surface and deep water represent a vast resource of renewable thermal energy. One of the methods of harnessing this resource is an open-cycle Ocean Thermal Energy Conversion (OTEC) system utilizing steam evaporated from the surface water for powering the turbine. In this paper, the state of the art of research and component development, as related to heat and mass transfer processes, power production, noncondensable gas handling, and seawater flow hydraulics, are described through an illustrated preliminary design study of a 1-MW facility.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 44081, 44086, 44094, 44102, 44443, 44548, 44564

44029 (CONF-801197—, pp 35-40) **Earth-air-thru-pipe system.** Southard, J. (Mississippi County Farm Bureau, Blytheville, AR). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The author estimates he will save 90% of his cooling bill and 60% of his heating costs in the new home he is constructing. Outdoor air is drawn through underground pipes, which act as heat exchangers to moderate the extreme air temperatures. Outside temperatures varied from a low of 8° in February to a high of 110° in July. Cold air was warmed to between 41 and 57° while checked during January, February and March. On the cooling side, during extreme July heat ranging from 80 to 110°, the fan discharged air at temperatures from 67 to 71°.

44030 (CONF-801197—, pp 50-57) **Integrating solar, wood & water with an earth-sheltered home.** Meyer, H. (Marion County Farm Bureau, Yellville, AR). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

An earth-sheltered home is under construction near Yellville, Arkansas. Plans are to integrate a greenhouse and a passive solar heating system with heat storage and a wood furnace as a backup. Sun tracking skylights powered by the sun will provide day lighting. The house will require no outside power sources.

44031 (CONF-801197—, pp 103-109) **Passive solar living.** Glass, L.D. (Savell Systems International). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

This passive solar home utilizes the ground temperatures for both heating and cooling. By creating a massive structure of concrete walls and floors and applying insulation to the exterior walls we have energy savings up to 60%. It takes relatively unskilled labor and is competitive with conventional construction costs. The earth has a constant temperature line several feet beneath the surface. This temperature remains steady summer and winter. In Des Moines, Iowa, this is around 56°F. This is the point where all the summer heat and winter cold are balanced out by the shear mass of soil and rock beneath the surface. The foundation is no different than standard construction with the exception of an 8 inch offset to receive exterior wall panels. Walls are formed on casting beds. After a few days, insulation is applied to the exterior walls. This is a very important part to the Savell System. This acts as a cushion to relieve expansion and shrinkage stress inherent in concrete. It is also an insulator. The wall panels are now ready to be transported to the construction site. This system of building results in lower costs and energy savings while maintaining high quality construction.

44032 **(CONF-850905—1) Evaluation of solar heating systems with seasonal storage in New England. Systems using duct storage in rock and heat pump.** Breger, D.S.; Michaels, A.I. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013848.

From ENERSTOCK '85 - international conference on energy storage for building heating and cooling; Toronto, Canada (22 Sep 1985).

This Evaluation focuses on the New England region of the United States, and considers seasonal storage of solar energy using duct storage in rock and a heat pump. Adequate bedrock for large scale storage is available in the New England region and the climate, which includes cold, relatively cloudy winters and summers with substantial insolation, makes seasonal storage technology of particular interest. This analysis has been performed within the context of the International Energy Agency, Solar Heating and Cooling Program, Task VII on Central Solar Heating Plants with Seasonal Storage (CSHPSS). The general results of the analysis indicate that the optimized systems provide 75 to 80% of the low temperature demand load and 60 to 65% of the high temperature demand load with solar energy, with the remaining portion coming primarily from the heat pump electrical input energy. The annualized cost of the energy supplied by the system to the distribution network using the base case economic scenario is $44 to 52/MWH and $58 to 62/MWH for the low and high temperature loads, respectively. Significant reductions in cost are found when systems are financed with present incentives provided by the federal government. These results are encouraging in terms of the system cost-

effectiveness relative to energy costs in the New England area which are comparable to these values.

44033 (CONF-8209265—, pp 1-34) **Solar House Obdach: experiences with a solar ground-coupled storage system.** Bruck, M.; Blum, P.; Held, E. (Austrian Solar and Space Agency, Vienna). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Within the framework of the Solar House Obdach-project, a system consisting of a ground heat exchanger, a low-temperature collector, a water-glycol/water heat pump and a low-temperature heating system was examined with regard to its suitability as only heat source of a house. With the design chosen (1 m^2 ground collector area and 0.3 m^2 low-temperature collector area per 80 W load), a seasonal performance factor of 2.83 could be obtained. About 40% of the low-temperature heat supplied to the heat pump were delivered directly or indirectly (by means of short-term storage in the ground) by the low-temperature collector, whereas about 60% came from the natural sources of energy of the ground (air heat, radiation, precipitation, ground water and slope water). The results obtained are used to verify and improve a computer model design program for ground collectors and ground-coupled storage systems which should help to optimize the design of solar plants, particularly under difficult conditions.

44034 (CONF-8209265—, pp 35-51) **Project Perstorp: a combined surface-soil and solar heating system for a group of detached houses.** Gusten, J.; Baeckberg, H. (Chalmers Univ. of Technology, Gothenburg, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

A combined surface-soil and solar heating system for a group of five detached houses is described. The purpose of the work was to study the economy and the dependability of the system. The amount of electrical energy consumption needed for the heating of the houses and the water was also examined. Measurements indicate that the saving of energy is lower than expected owing to large heat losses from the culvert elements and defective reliability of the system.

44035 (CONF-8209265—, pp 52-68) **Loft solar collector with heat storage in the ground under a house.** Hansen, K.K.; Hansen, P.N. (Technical Univ. of Denmark, Lyngby). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The test stand on the University of Denmark campus contains the following three elements: the loft solar collector, the low temperature heat storage in the ground volume under the house, and the control room which is situated to the rear of the loft solar collector. The solar system is simulated using the weather data from the reference year. The heat is transferred from the loft to the storage by air and then extracted from the storage by the aid of a heat pump (water/water). In this way the system, which is based on a 22 m^2 transparent roof, can heat the control room (30 m^3) throughout the heating season. The major conclusion is that the ground heat storage is too small (the surface/volume-ratio is too high) and the storage will, therefore, be empty in February. A larger storage volume must be used.

44036 (CONF-8209265—, pp 69-86) **Some experimental results on coupled systems: air collectors, ground storage, heat pump.** Deroyon, J.P.; Desmoucelles, M.; Martin, M.; Le Ray, M.; Torguet, R. (Universite de Valenciennes, France). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The initial experimental results obtained on a coupled system comprising a solar collector, ground storage and heat pump are presented. The novelty of the system is that thermal regeneration is by means of solar collector employed to heat atmospheric air, which is then blown through a system of buried plastic piping for heat exchange with the subsoil. The experimental work commenced in October 1980 over the first year (October) 1980/October 1981). The temperature of the subsoil was allowed to regenerate naturally. As from October 1981, the air collectors were made to contribute to raising the storage temperature. The results reported were obtained on three different houses located in Northern France.

44037 (CONF-8209265—, pp 87-98) **Storage of solar energy with horizontal pipes in the ground.** Rudholm, B.; Hultmark, G. (Bengt Dahlgren AB, Goeteborg, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Sweden is dependent of oil for the major heating demand in industries and buildings. The work of lowering oil consumption often takes the opportunity to use heat pumps, lowering the oil consumption, and using electricity in small proportions. The price of electricity is low compared to oil. The major electricity production is still coming from hydro power. In the spring, summer, and autumn periods plenty of electricity is available to operate electric driven heat pumps. In order to get a good heat source for the heat pump, even in the wintertime, ground heat storage is used. One possibility to get cheap heat storage is to use the natural ground. In this project, the natural ground consists of peat. Of the total area in Sweden about 12% is covered with peat and about half of that area is useful peat to store energy. Peat ground is normally good as a heat store medium while most of its properties are the same as water and on the top there is a good insulation layer. This makes it possible to store heat and still not be forced to go too deep into the ground. The construction of this project began in 1980 and the system was operating in the summer 1981. The total building is now completed.

44038 (CONF-8209265—, pp 99-121) **Experiences with solar coupled storages with heat pumps for space heating in Austria.** Ruenzler, H.; Faninger, G. 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The use of solar-assisted heat pumps with ground coupled energy storage for space heating in Austria is discussed. The subject is discussed under the following topics: meteorological conditions and potential for solar energy utilization; solar energy applications and market penetration; results of research, development and demonstration in the field of solar and heat pump systems for space heating; and the Bludenz solar house.

44039 (CONF-8209265—, pp 122-157) **Central solar heating plants with seasonal storage.** Chuard, D.; Hadorn, J.C.; Van Gilst, J. 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

On May 9, 1979, the Federal Department for Buildings released instructions concerning the use of alternative energies. The federal energy policy is to be as much as possible independent on oil imports. The canton Fribourg decided to equip the new maintenance and service center for the national high-road N12, with alternative energy, resources, and to apply new concepts with respect to passive and active solar energy. The project uses active solar energy with an earth-storage and heat pump. A conventional oil-heating system provides energy for peak-loads and can be operated in stand-by. A delay in the construction of the earth storage sub system was requested because it was intended to optimize the system with respect to the solar sub system, and heat pump sub system. The design work was done by SORANE which also is the coordinator for Switzerland in the I.E.A. Task VII. However, the preplanning of the project started in 1978 before the I.E.A. Task VII started. As a consequence, many design parameters were determined before 1980. The optimization of the solar collector, heat-pump etc. sub system was performed by a simulation approach developed by SORANE. The Vaulruz service center has been commissioned during the winter 1981/82.

44040 (CONF-8209265—, pp 158-170) **Some measurement results on commercial heat pump systems with solar collectors and ground storage.** Suter, J.M.; Valenti, P. (Swiss Federal Institute for Reactor Research, Wuerenlingen). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Within the framework of a large measurement program on commercial heating systems with solar collectors in various parts of Switzerland, some solar-assisted ground-coupled heat pump systems were studied under actual service conditions. A system with unglazed low-temperature collectors, installed in a single family house of the Swiss Midlands is discussed. A daily analysis of the system (energy balance and solar collector heat gain) is given for November and December 1981. The energy balance is also presented on a monthly basis for the heating season 1980-81. The system is found to be suitable to the climate of the Swiss Midlands and to work satisfactorily, although the storage losses and the parasitic electrical power of the auxiliary equipment could be reduced with benefit. The measured seasonal coefficient of performance of the heat pump including the parasitic electrical power is 2.4. Some preliminary results obtained on other systems are briefly mentioned for the sake of comparison. Neither a comparison with theory nor an economical analysis is made. However, interesting considerations can be made on the climatic dependency of the configuration of such systems and on some sensitive points which have to be considered at design time.

44041 (CONF-8209265—, pp 171-198) **Heating of a laboratory hall by means of a soil heat pump combined with unshielded solar collectors.** De Hoe, J.M.; Geeraert, B. 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Experimental results are presented for a 500 m^2 laboratory hall heated during the season 1980/81 by three soil heat pumps using only 620 m^2 soil surface for the double layer horizontal pipe heat exchanger buried at low depth (0.6 m and 1.2 m). The energy demand was lowered to 45% of the demand in case of resistance heating. Experimental results correspond to predicted ones. During the heating season 1981/82 two of the soil heat exchangers were combined with unshielded absorbers. Fifty-two m^2 of energy facade were coupled through an intermediate three-way motorized valve with a 207 m^2 soil heat exchanger. The lowest surface temperature of the pipes could be limited in this way to +2.5°C instead of -2.5°C without the energy facade. From March on, the soil temperature was higher than the undisturbed soil temperature at the same depth. The other soil heat exchanger of 207 m^2 was used alternately with a 40 m^2 energy enclosure with manual commutation. At +3°C outside air temperature the evaporator temperature of the heat pump reaches the minimum allowable value of -10°C. Automatic actuation of the commutation to the soil heat exchanger is necessary. The payback period of a non assisted soil heat pump installation, compared to resistance heating is in the order of 13 years. Energy facades (or roofs) can only become cost efficient if they are integrated in the building structure.

44042 (CONF-8209265—, pp 201-220) **Selection of optimal ground coupled solar heat pump systems.** Andrews, J.W. (Brookhaven National Lab., Upton, NY). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104. Contract AC02-76CH00016.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

An analysis of combined solar heat pump systems has been carried out as the culmination of a five-year program of research sponsored by the US Department of Energy (DOE). Ground coupling has played a major role in this effort. The history of the program is discussed, including the role of ground coupling, and the results of the analysis for two categories of ground coupled solar heat pump systems are presented. These are: (1) systems in which the ground is used as a source and sink for heat, but solar heat is not stored in the ground; and (2) systems in which solar heat is stored in the ground.

44043 (CONF-8209265—, pp 221-241) **Heat losses from a ground storage, a study with subroutines from SUNSYST.** Hultmark, G. (Ab Andersson and Huhmark, Goeteborg, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

SUNSYST is a computer-program that calculates temperatures and thermal powers in a system containing a building with a heat pump, a tube storage system in the ground and solar collectors or wind convectors. The most important results that SUNSYST gives are the following: how much energy may be obtained from a flat solar collector with or without cover glasses; how the heat is spread in the ground and how much can be recovered in wintertime; and how much energy must be put into the heat pump. In the calculations the subsystems are assumed to work with the same average temperature. The problem is to find a temperature which results in the sum of the three thermal powers from the solar collectors, the dual storage system and to the evaporator in the heat pump becomes zero.

44044 (CONF-8209265—, pp 242-257) **Experimental comparison of the performances of various energy roofs and unglazed absorbers at the outdoor test facility of the Swiss Federal Institute for Reactor Research (EIR).** Keller, J.; Imhof, A. (Swiss Federal Institute for Reactor Research, Wuerenlingen). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

In the last few years increasing interest has been devoted to room heating by means of heat pumps. Apart from air-to-fluid heat exchangers, also low temperature absorbers and so-called energy roofs are used as energy collecting components. However, in contrast to the glazed collectors for hot water preparation, the properties of these components are not yet well known. Particularly the parameters characterizing the behavior of an energy roof operating at temperatures below the ambient temperature are not necessarily identical to those describing a hot water collector. In order to investigate experimentally these components, the existing outdoor collector test facility at the institute was extended by four test places of 6 m^2 each (collector surface). For these places the flow rate was increased from 100 to 600 l/h and the lowest achievable temperature decreased from about +15°C to -5°C. This low temperature lying, in most cases, below the ambient temperature is maintained by a cooling unit of 18 kW cooling power. From May to June and September to December 1981, five different types of energy roofs were investigated. Daily heat outputs on clear spring days were found to amount to 6 kWh (m^2) at fluid temperatures below the ambient temperature. The heat transfer coefficient showed a variation from 6 to 20 W/m^2K and may increase to 25 W/m^2K for a special, forced ventilated collector-like element. In addition a considerable dependence of this parameter on wind velocity was found. The optical efficiency varied between 0.4 and 0.8 depending on the absorptance of the surface and the heat transfer from the surface of the element to the fluid.

44045 (CONF-8209265—, pp 258-272) **Heliogeothermal doublet: application to 224 collective apartments.** Iris, P. (Ecole des Mines de Paris, France). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Because their temperature remains constant, aquifers represent a natural amount of heat well adapted to the heat pumps, which can work during the whole season with constant performance. In the north of the Parisian region, for example, there is a regional sandy aquifer which covers 12,000 km^2. The average temperature of the aquifer is 13°C, its depth is 80 m, and its thickness is about 20 m. The average flow rate per well is about 60 m^3/h with a potential thermal power of 600 kW. Consequently, this aquifer, which is not utilized at the present time on a thermal point of view, represents a very attractive reservoir for central collective heating. A project is proposed that is well adapted to the dense urban area of the Parisian region and capable to generalized use without spoiling the underground resource. The initial question is

to find out if it is possible to use the aquifer by classical ways such as: (1) to pump the water and to reject it into the surface network; and (2) to pump the water and to inject it after cooling into the aquifer by a second well. The feasibility of the two methods were studied.

44046 (CONF-8209265—, pp 273-288) **Study of a heating system using a water-water heat pump, solar panels without covers and low temperature heat storage.** Blaude, P.; Golinval, J.C.; Goreux, E.; Hannay, J.; Lebrun, J.; Nusgens, P. 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

For a few years, solar coupled systems with heat pumps have appeared as an alternative to conventional heating systems. Experimental studies in situ have become more and more necessary to estimate global energy performance and to complement theoretical analysis. A low energy house was used as an experimental tool for four years for these studies. From the beginning, the research project for this house has been more of an experiment than a payback demonstration: as conceived, the heating system does not pretend to be economically efficient for the user. Conversely, the system has been over-equipped and oversized to allow a more complete instrumentation. The development of the project is discussed.

44047 (CONF-8209265—, pp 289-311) **Solar collectors in combination with aquifer and heat pump.** Snijders, A. (Heidemij, Research and Development Dept., Arnhem, Netherlands). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Aquifers can be used for seasonal thermal energy storage in solar systems for space heating. The characteristics of ATES are discussed in relation to the impact on the other components of the solar heating system. The aquifer is taken as the starting point because of the fact that the physical properties of the aquifer cannot be changed at a chosen location. Promising combinations are low permeable aquifer - high performance collectors and high permeable aquifer - low performance collectors - heat pumps. A short description is given of some projects in the Netherlands which are set up to investigate the behavior of solar coupled ground storage.

44048 (CONF-8209265—, pp 312-336) **Performance of a hybrid solar heating system of the solar laboratory at the JRC-Ispra.** van Hattem, D.; Aranovitch, E.; Actis-Dato, P. (Commission of the European Communities, Ispra, Italy). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The average European winter weather conditions are ill-suited to cost-effective solar space heating systems. Conventional active solar systems cannot be expected to deliver over 150 kWh/m^2 of solar collector annually, thus leading to excessively long payback periods. For this reason a great deal of attention has been paid in recent years to solar systems which can be operated over longer periods of time per year and at lower temperature levels. In this respect, the so-called hybrid systems, combining a solar system with a heat pump and a long-term energy storage system, look particularly promising. The introduction of a heat pump in large solar heating systems with a long-term heat storage, can significantly improve the performance of the system, while the cost of the heat pump is only a small fraction of the total system costs. Such a system has been used to heat the solar laboratory and has intensively been monitored over a period of three years. The performance of the system is discussed.

44049 (CONF-8209265—, pp 337-390) **Simplified model for the technic-economic evaluation of a solar system coupled with seasonal energy storage and a heat pump.** Aranovitch, E. (Commission of the European Communities, Ispra, Italy). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

An evaluation, based on the experience of the past years, shows that most solar space heating systems are non-economic, at this stage, for the greater part of Europe. The performance over cost ratio of these systems is strongly affected by the fact that most of them operate only during the heating season, a period when they utilize from 30% to 40% of the yearly solar energy available. If they could be made to operate all year round, their annual energy output could be significantly increased. For this reason, the problem of season energy storage, by which heat is accumulated in the summer and used in the winter, is becoming the object of increasing attention and is often considered as the crucial one to be solved, if solar space heating is to have a future. Another factor which strongly influences the overall performance of a solar system combined with a large storage device is the temperature levels of operation, which affects not only the efficiency of the solar collectors, but also the heat losses from the store. The introduction of a heat pump into the system not only makes it possible to lower the temperatures in the collectors and in the store, but also represents a flexible and convenient back up system. The evaluation of the interactions between the solar system, the storage device and the heat pump, as far as the performance versus cost aspects are concerned, will require very elaborate models if these interactions are to be studied in detail. A simplified model dealing with a reference system is presented. The model should give indication as to the first order weight of the main parameters and provide guidelines to the design criteria of solar systems combined with a heat pump and a seasonal energy storage device.

44050 (CONF-8209265—, pp 393-432) **Earth coil/heat pump research at Oklahoma State University.** Bose, J.E. (Oklahoma State Univ., Stillwater). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

Projected energy costs and summer peaking demands on the electric power generation system in many parts of the US have resulted in the investigation into (a) horizontal and vertical earth-coupling heat exchanger types, (b) thermal performance, installation costs, and characterization by type of these devices, (c) computer modeling and design procedures, (d) methods and economic considerations of trenching single and multi-layered horizontal earth coils, (e) low horsepower machinery to reduce drilling costs in vertical heat exchangers installed to depths of 100 M, (f) mechanical installation of coiled high-density polyethylene pipe U-tubes for vertical heat exchangers to depths of 100 M, (g) developments of a minimum overall dimension U-tube fitting to minimize bore diameters that are butt-fused to polyethylene pipe to ensure leakproof operation, (h) plastic pipe to copper pipe transition fittings for interfacing earth coils to heat pump circuits, and (i) methods of disseminating the design and research details to the general public, heat pump manufacturers, dealers, installation crews, and generating utilities personnel. The accelerated program is the result of a cooperative effort of Oklahoma State University personnel, government research personnel, US Department of Energy contracts, and private industry. The major contributions of these combined research efforts are discussed.

44051 (CONF-8209265—, pp 433-445) **First year operation with a seasonal storage of 80,000 m^3 clay.** Hultmark, G. (AB Andersson & Hultmark, Goeteborg, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The SUNCLAY Project in Sweden is described. Sweden is dependent of oil for the major heating demand in industries and buildings. One possibility to lower the oil consumption without increasing the electricity demand is to use diesel-engine-driven heat pumps. To become a reasonable heating factor it is necessary to raise the temperature on the evaporator side of the heat pump. The SUNCLAY Project uses 88,000 m^3 of clay to store solar energy from summer to winter. The size of the storage reduces the losses to a reasonable level. The construction began in 1978 and continued in 1979. In the summer 1980 the storage was built and the first 750 m^2 of solar collectors was installed. During the winter 1980-1981 heat was extracted from the ground, and in April 1981 the solar

collectors had collected the same amount of energy which was taken out in the winter. In March 1982 the final area of 1500 m^2 solar collectors was installed.

44052 (CONF-8209265—, pp 446-474) **Sigtuna Project and application studies.** Margen, P.; Platell, O. (Studsvik Energiteknik AB, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The storage of low grade heat in a ground store with appropriately spaced substantially vertical channels for charging and uncharging is discussed. The annual storage of solar heat to meet the winter space heating demand is discussed. This is an essential feature of any Swedish solar heating scheme aiming to supply a major fraction of the space heating demand, as insulation and heat demand are very strongly out of phase. The second application is the storage of industrial waste heat exceeding summer heating demands. Both applications can be covered by systems with or without the use of heat pumps. Some of the work done on demonstration plants and projections for larger scale applications are reviewed.

44053 (CONF-8209265—, pp 475-494) **Solar assisted heat pump system and in-ground energy storage in a school building.** Poncelet, J.P.; Nicolas, J. (Fondation Universitaire Luxembourgeoise, Arlon, Belgium). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

For a quarter of a century, Belgium's energy balance shows a large deficit. In spite of significant benefits from governmental financial aid, national energy resources, especially coal, do not contribute more than 10% of the national energy needs. Annual oil imports amounting to a rough 5 billion dollars in 1981 were necessary to satisfy the half of the 48 Mtep total energy demand. A national R-D program on energy has been initiated, that mainly focuses on technico-economical analysis and modelling, rational use of energy and renewable energy resources. However, a large scale experiment of a solar energy system was needed which would demonstrate the feasibility of the system and the relevance of the concept, and would allow correct validation of the models from measured data. The first Belgian experiment of a solar assisted heat pump system combined with a large scale long-term in ground storage of heat is currently in progress in the southern city of Arlon. The thermal load of the system is a 3500 m^2 building in three modules. The load includes the needs for space heating, hot water and cooling (in the latter mode the waste heat is rejected to the storage); an additional ground coupling can be substituted for the storage as a source to the heat pump. The whole system is intensively instrumented and managed by a micro-computer based process control system. The design and operation of the system are described.

44054 (CONF-8209265—, pp 495-517) **Three years experiences from a summer stored earth-heat-pump-system.** Rosenblad, G. (Chalmers Univ. of Technology, Goeteborg, Sweden). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The Utby project has the intention to investigate the possibilities to use an earth heat pump system with vertical tubes. The advantages of such a system are discussed. The project started with the building of the storing system in May and June 1979 and with heating the house in October the same year. Thus, three years of experience have been realized despite several construction changes that occurred during that time. The charging started on June 20 in the same year at a time when it was estimated that a storage, if used in wintertime, would have regained the temperature level of the undisturbed ground. The next years experience demonstrated that this point occurs two or three weeks later.

44055 (CONF-8209265—, pp 518-526) **Study on long-term underground heat storage with vertical storage coil.** Tanaka, T.; Miyakawa, Y.; Yasue, S. (Ohbayashi-Gumi Ltd., Osaka, Japan). 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

A study of long-term underground heat storage has been conducted since April, 1980, as one of a series of studies on solar heating, air conditioning and water-supply system research and development in the Sunshine Project. This study is aimed at developing the technology for heat storage with which the surplus heat in the intermediate season is stored underground and from which the stored heat is drawn for use in winter. The experiment was performed with vertical heat storage coils. The experimental system, the measuring system, and the result of system operation are discussed.

44056 (CONF-8209265—, pp 529-540) **Market potential for solar assisted ground coupled heat pumps.** Harris, J.F. 14 Sep 1982. NTIS (US Sales Only), PC A24/MF A01. File Number DE85900104.

From Workshop on solar assisted heat pumps with ground coupled storage; Ispra, Italy (14 Sep 1982).

The objective of this study was to assess the market prospects for solar assisted ground coupled heat pumps (SAGCHPs) in residential buildings, to identify systems with significant potential and to determine the barriers that constrain the market for SAGCHPs. Among the three technologies included in SAGCHPs, this study focused on heat pump technology and analyzes the contribution of solar energy and seasonal storage to the improvement of the seasonal performance factor (SPF), since heat pump is the most advanced of the three technologies. The market study concerns four countries: France, Germany, Sweden and the US. In addition some information was obtained for the United Kingdom. The key results of the market assessment for each country are reported.

44057 (DOE/CS/30221—T2) **Determination of properties of fluids for solar cooling applications. Final report.** Podoll, R.T.; Gray, T.E.; Rolon, C.E.; Sabo, K.A. (SRI International, Menlo Park, CA (USA)). Aug 1982. Contract AC03-80CS30221. 125p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017219.

The objectives of the project were to perform a detailed literature search for the available thermodynamic data of proposed refrigerant/adsorbent pairs (pure fluids and binary fluid mixtures) and to measure those data that were unmeasured or unreliable. The data to be obtained for the pure fluids included critical properties, the vapor pressure curve, the heat of vaporization at the normal boiling point, the freezing point, the specific heat of the liquid and vapor, and the specific volumes of the saturated liquids and vapors. For the fluid mixtures, the data included saturation temperatures, heats of mixing, and specific heats at several solution compositions. Most of the required thermodynamic data for the pure refrigerants were found in the literature survey. Very few data were found for the pure absorbents, but the normal instability of several of the absorbents was discussed in the literature. Methods for estimating pure fluid data were evaluated, and estimated thermodynamic values were given. No data of sufficient accuracy were found for any of the fluid mixtures. Thermal stability tests were conducted with all the absorbents. These tests indicated that ethylene glycol and 1,4-butanediol were too unstable to be considered for use at operating temperatures of 200°C. Therefore, no experimental work on the ethylene glycol, 1,4-butanediol, and their six binary mixtures with ammonia, methylamine, and ethylamine was undertaken.

44058 (DOE/CS/30300—T1) **Residential Passive Solar Energy Program.** (NAHB Research Foundation, Inc., Rockville, MD (USA)). Nov 1984. Contract FG02-79CS30300. 217p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85006722.

This report outlines a residential passive solar energy program which was performed. Areas covered by this report are the following: Passive energy systems for construction/field testing; Rymark III, Phase change ceiling system; Rymark III-Performance; Rymark I-III-Building infiltration study; Rymark home shading study using CALPAS V.3.01. Rymark stands for the model name used by Ryan Homes, Inc. for each of the houses tested.

44059 **(DOE/CS/31718—T1-Vol.1) Development of solar assisted heat pumps for the heating and cooling of buildings. Volume I. Final technical report, February 1, 1978-June 30, 1980.** (Northrup, Inc., Hutchins, TX (USA)). 1980. Contract AC03-78CS31718. 249p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85016462.

The hardware development of optimized high efficiency vapor compression cycle heat pumps for use in conjunction with solar assisted heat pump (SAHP) systems was the primary focus of this program. The overall development effort included SAHP designs for residential and commercial building schemes, but the principal effort was directed towards the residential application. A systematic development approach consisting of several program phases was taken. The phases included system design and evaluation, heat pump detailed design, hardware fabrication, and hardware testing. A marketing analysis plan for commercializing these systems was assembled.

44060 **(DOE/CS/31718—T1-Vol.2) Development of solar assisted heat pumps for the heating and cooling of buildings. Volume II. Final technical report, February 1, 1978-June 30, 1980.** (ARCO Comfort Products Co., Hutchins, TX (USA)). 1980. Contract AC03-78CS31718. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85016463.

A second volume containing the appendices to the report on the development of high efficiency vapor compression cycle heat pumps for use in solar assisted heat pump (SAHP) systems is presented. A water source heat pump and a solar powered absorption chiller are studied for their feasibility in improving the performance of a SAHP system. A two speed multiple level heat pump compressor is analyzed. The product data for two advanced water source heat pump models are provided along with operating instructions for a parallel compressor water source heat pump. Marketing data for SAHP systems are included.

44061 **(DOE/ET/20110—11) Test facility for the solar-powered/fuel-assisted hybrid Rankine cycle ('SSPRE'). A Phase III report.** Subbiah, S.; Lior, N. (Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics). May 1983. Contract AC03-78ET20110. 244p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85015602.

This report describes the design and construction of an experimental test facility to test a novel hybrid steam Rankine cycle. Steam from the municipal pipes is conditioned to simulate that generated by a low temperature source, such as solar energy at about 100°C. It is then superheated up to about 600°C in a gas-fired superheater, and drives a novel counter-rotating radial turbine. Some of the heat is regenerated and the steam is then condensed. The design of the test facility was based on the ASME steam turbine test codes, and on a thorough error analysis which helped identify unacceptable errors. The test-bed was built in the power laboratory of the University of Pennsylvania. The lay-out of the components was based on a "bread-board" approach, to allow easy testing and replacement of components, and yet keep the pressure drop in the steam pipes to an acceptably low level. The facility is carefully instrumented to measure all variables of interest: 19 temperature sensors, 23 pressure sensors, 9 differential pressure sensors, 2 level gauges, 7 flowmeters, 1 torque and 1 RPM measuring sensor, and a dynamometer, are used. A computerized data acquisition system is used to scan and measure 32 of these variables, and programs were developed to have it perform real-time analysis and output the results. Turbine supervisory monitoring instrumentation was installed for speed, vibration, bearing oil temperature and pressure, and location of the rotors. The control system was designed to automatically shut the steam supply and the superheater, and brake the turbine, whenever any of turbine's supervisory monitors senses an unacceptable excursion, or by manual input from the operator. A detailed program for testing the turbine and cycle performance over a wide range of parameters is presented.

44062 **(DOE/SF/11504—T3-Vol.1) Development of radiative cooling materials: Phase III. Final technical report. Volume I.** (Energy Materials Research Co., Berkeley, CA (USA)). [1985]. Contract FC03-80SF11504. 100p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85014666.

Research on far infrared (FIR, 8-13 micron) transparent polyethylene glazing and FIR selective emitter films for radiative cooling applications was conducted. Materials performance goals were developed from computer modelled cooling calculations of horizontal radiative cooling panels. Emphasis was placed on determining the minimum glazing properties necessary to allow "daytime" cooling. Minimum solar reflectances for polyethylene glazings were calculated to be between 0.60-0.93 depending on other glazing and radiator properties. FIR selective radiators significantly reduced necessary glazing solar reflectance when glazing was also solar absorptive. Glazing films produced were solar transparent, absorptive, or reflective. Approximately 70% solar reflectance was achieved with ZnO pigment while maintaining minimum of 75% FIR transmittance. This glazing would allow cooling if insolation is less than or equal to 800 W/m^2. ZnS pigmentation produced better solar reflectance but dramatically reduced film FIR transmittance. Neither Ferro Corp's F-6331 black nor fine particle carbon black were found to be good solar absorptive pigments for thin polyethylene films due to high FIR absorption. Poor mechanical properties prohibited development of good selective radiator films from SiO_2 and Si_3N_4 pigmented polyethylene.

44063 **(DOE/SF/11504—T3-Vol.2) Development of radiative cooling materials. Phase III. Final technical report. Volume II.** (Energy Materials Research Co., Berkeley, CA (USA)). 1983. Contract FC03-80SF11504. 231p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85014667.

Research on far infrared (FIR, 8-13 micron) transparent polyethylene glazing and FIR selective emitter films for radiative cooling applications was conducted. Materials performance goals were developed from computer modelled cooling calculations of horizontal radiative cooling panels. Emphasis was placed on determining the minimum glazing properties necessary to allow "daytime" cooling. Minimum solar reflectances for polyethylene glazings were calculated to be between 0.60 to 0.93 depending on other glazing and radiator properties. FIR selective radiators significantly reduced necessary glazing solar reflectance when glazing was also solar absorptive. Glazing films produced were solar transparent, absorptive, or reflective. Aproximately 70% solar reflectance was achieved with ZnO pigment while maintaining minimum of 75% FIR transmittance. This glazing would allow cooling if insolation is less than or equal to 800 W/m^2. ZnS pigmentation produced better solar reflectance but dramatically reduced film FIR transmittance. Neither Ferro Corp's F-6331 black nor fine particle carbon black were found to be good solar absorptive pigments for thin polyethylene films due to high FIR absorption. Poor mechanical properties prohibited development of good selective radiator films from SiO_2 and Si_3N_4 pigmented polyethylene. This volume contains the final appendices of the report including the solar and far infrared spectra.

44064 **(DTH-LV-MEDD—164) Heat exchange in small solar heating systems.** Oestergaard Jensen, S. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Nov 1984. 78p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752484.

EFP-82; EFP-83.

Investigations concerning the suitability of different designs of the heat exchanger spiral in a hot water tank for solar heating systems for domestic hot water supply have been carried out. Rules of thumb have been established concerning the length of the heat exchanger spirals. In addition investigations concerning the influence of the volume flow rate in the heat exchanger spiral, the dimension of the tube in the heat exchanger spiral, a possible cover of lime on the heat exchanger spiral and the influence of the used solar collector fluid on the performance of a solar heating system have been carried out. The suitability of different advanced heat storages in solar heating systems for domestic hot water supply has been investigated. The investigated heat storages had: No thermal conductivity in the storage, a stratification preserving water draw-off system, a stratification creating heat supply system and a variable storage volume.

44065 (ERC-R—83043) Performance characteristics of open-flow liquid desiccant solar collector/regenerator for solar cooling applications. Part I: two dimensional analysis of heat and mass transfer for open flow over rough inclined surfaces. (Arizona State Univ., Tempe (USA). Coll. of Engineering and Applied Sciences). Nov 1983. Contract AC03-82SF11691. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85014778.

This work presents an analytical approach to simulate the combined heat and mass transfer on the interface between wetted collector surface and ambient air. Emphasis was placed on the development of a mathematical model of turbulent natural convection on an inclined rough plate. The effect of surface velocity is also considered. The systems of partial differential equations governing fluid motion, heat and mass transfer along an inclined flat plate were formulated in terms of vorticity transport and stream function equations. One-equation model of turbulence was used to compute the turbulent viscosity. The length scale used in this model was expressed algebraically in terms of the mixing length. A length scale modified function was derived to take into account the bouyancy effects on turbulence. The effect of surface roughness was taken into a account by introducing a characteristic roughness length. A computational technique was developed to solve the resulting elliptic partial differential equations. This technique involved an 'inflow-outflow' scheme to determine the free boundary conditions at the leading and trailing edges of the inclined plate. The validity of this computational technique was tested and confirmed by some testing problems. Among these are (1) laminar natural convection on an inclined isothermal plate (2) turbulent natural convection on a vertical isothermal plate and (3) turbulent natural convection on an inclined constant heat flux flat plate.

44066 (EUR—9143/II-EN) Modelling of thermal storage for solar heating systems. Final report. Vol. 2. Marshall, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 419p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

In this final report is presented a detailed account of the work conducted on the project "Modelling of Thermal Storage for Solar Heating Systems", to the funding bodies. The 5 project subtasks are outlined. Thereafter details are given of the progress and conclusions reached for each sub-task. The study reveals that for solar applications, system performance is most strongly influenced by the collector quality and the heat emitter distribution circuit. The influence of the storage mode, either fully mixed or stratified, the storage material, phase change or water storage, and the storage capacity is of secondary importance. A comparison of thermal performance between the various storage modes and materials indicates that there is little improvement to be gained by an alternative storage device compared with a fully mixed water store with a minimum useful temperature of some 25°C and a parallel auxiliary system. Therefore, a design method must be employed so that the choice of the storage mode, material, and capacity is made on the basis of an economic analysis. The state-of-the-art in the derivation of a universal design method is described. Further work is needed to extend the method to include combined space heating and domestic hot water. In view of the poor commercially available collector quality and current less than adequate heat distribution design, the conclusions of this study indicate that improvements in both the collector quality and emitter performance should have the highest priority but that research is still needed on characterising storage devices by means of test procedures and in reducing their cost.

44067 (EUR—9719-EN) Solar space heating systems and domestic hot water. Dutre, W.L.; Vermaete, G.; Deceuninck, P. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 209p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The objectives of the European Modelling Group for Solar Heating Systems and Domestic Hot Water, during the period from January 1980 to July 1981, included the development of models to simulate the SPTF-SS1 system, to investigate the sensitivity of the models to various system parameters and to validate the models by comparison with experimental data from the SPTF-systems. The model developed at the K.U.L. has been used for these various activities. From the results of the validation calculations it can be concluded that the dynamic behaviour of the model is in good agreement with the experimental data. It has been recognised that the differences between predicted and measured values are very sensitive to the inaccuracy of the input data, which may even have a larger influence than the physical and mathematical approximations of the model itself, such that physical model improvements could not be developed.

44068 (FRNC-TH—1550) Modelling and control of a solar dryer. Chaptal, M. (Toulouse-3 Univ., 31 (France)). 1982. 98p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750556.

The description of models using various elements of an experimental dryer composed of collectors, a storage unit, and a drying box is presented. The dryer model is simplified and the adjustment of it is done by an identification procedure. For two possible configurations of the system, the control law is determined, one consisting of air collectors directly connected to the drying box, the other one consisting in a dryer, a thermal storage unit, and collectors.

44069 (LA-UR—85-2703) Passive vapor transport solar heating systems. Hedstrom, J.C.; Neeper, D.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-851030—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015736.

From SOLAR '85; Raleigh, NC, USA (15 Oct 1985).

In the systems under consideration, refrigerant is evaporated in a solar collector and condensed in thermal storage for space or water heating located within the building at a level below that of the collector. Condensed liquid is lifted to an accumulator above the collector by the vapor pressure generated in the collector. Tests of two systems are described, and it is concluded that one of these systems offers distinct advantages.

44070 (LBL—17071) Applied Science Division annual report, Solar Energy Program FY 1983. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016491.

In FY 1983, LBL's research on solar energy included: passive solar, optical materials, active solar cooling, the photoelectrical activity of bacteriorhodopsin, and solar energy conversion using microstructured materials. Research in the passive systems development was directed at convection heat transfer, daylighting and passive cooling. Materials that can replace or supplement conventional glazing materials and provide large reductions in building energy use are identified. Thermodynamic cycles that can potentially increase the efficiency solar-driven absorption air conditioners are being studied. The microstructured materials research mainly involved the direct radiant heating of small particle suspensions, but included the development of transparent insulating windows and holographic optical elements as window coatings.

44071 (MTR—82W181) Proposed methodology for active solar research and development project selection. Leigh, J.G. (Mitre Corp., McLean, VA (USA). METREK Div.). Sep 1982. Contract AC01-81CS30630. 58p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016467.

This paper reviews published approaches to the R & D selection problem, and proposes a methodology tailored to the specific characteristics of the Active Solar Heating and Cooling Program Research Requirements project being conducted by the US Department of Energy. The methodology is described in two parts: (1) project figure of merit and cost development, and (2) project selection and program taxonomy. An illustrative example is given.

44072 (NMERDI—2-72-4212) Performance monitoring of the Sunmat laundromat. Final report. Farrer, R. (New Mexico Solar Energy Inst., Las Cruces (USA)). Aug 1985. 70p. NTIS, PC A04/MF A01 - NMERDI, Univ. of New Mexico, 457 Washington SE, Suite M, Albuquerque, NM 87108. File Number DE85902052.

The Sunmat laundromat in Columbus, New Mexico, was built with an air-based solar collection system that supplies heat to a large water storage tank, which has a propane-fired boiler backup. The storage tank supplies heat for the washers and the dryers. Systems have been installed to recover energy from the dryer exhaust air. The performance characteristics of the laundromat have been measured and analyzed. During a 25% loading schedule, propane provided approximately 81% of the energy used by the laundromat, the solar system provided about 9%, and the balance was supplied by electricity. The performance of various components and subsystems is analyzed and discussed. The operating characteristics of three types of clothes dryers were also analyzed. A Sunmat dryer, in which the gas-fired burner had been replaced by a water-to-air heat exchanger, was compared to a conventional propane-fired dryer and to a propane-fired dryer with a retrofitted exhaust air recirculation kit. The results indicated that the Sunmat dryer's efficiency was marginally to significantly better than that of the conventional dryer, depending on the method of hot water generation. The retrofitted propane-fired dryer used up to 28% less energy than the conventional dryer.

44073 (PB—85-194157/XAB) Solar-generated industrial process heat: proposal to the Ministry of Energy and Infrastructure. Volume 1. Summary of investment opportunity. (Luz International Ltd., Jerusalem (Israel)). 1981. 43p. NTIS, PC E04/MF E01.

See also PB85-194165.

Contents include: Projected returns on investment; Overview of investment opportunity; The market; The product; Market approach and projected long-term economics; Projected manufacturing; Contribution request and expected repayment schedule; and Expected return in terms of local employment.

44074 (PB—85-194165/XAB) Solar-generated industrial process heat: proposal to the Ministry of Energy and Infrastructure. Volume 2. Summary of investment opportunity. (Luz International Ltd., Jerusalem (Israel)). 1981. 126p. NTIS, PC E07/MF E01.

See also PB85-194157.

Contents include: General products summary; Discussion of technical capabilities; Schedule of events; Appendices--System test and test procedures; Back-up technical analysis; Tapud - prepared by engineering; Shemesh utility system top-level performance specification; Facility management top level specification; System performance analysis; and Manufacturing plan.

44075 (PB—85-195956) Design and analysis of passive-solar-heating solutions for neighborhood commercial-strip settings. Final report. Ruberg, K. (National Bureau of Standards, Washington, DC (USA)). 1979. 5p. (CONF-791022—). Published in Proceedings of the National Passive Solar Conference (4th), Kansas City, MO, October 3-5, 1979 p576-580.

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

As part of an NBS study on urban solar applications, two passive solar heating methods and preliminary thermal performance data are described for a prototypical neighborhood commercial strip.

44076 (PB—85-197556) Flow-rate calibration for solar heating and cooling system evaluation. Final report. Mattingly, G.E. (National Bureau of Standards, Washington, DC (USA)). 1978. 7p. (CONF-780432—). National Bureau of Standards, Washington, DC.

From Conference on performance monitoring techniques for evaluation of solar heating and cooling systems; Washington, DC, USA (3 Apr 1978).

Published in Proceedings of Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, Washington, DC, April 3-4, 1978, p299-305.

A description is given of the flow-metering calibration facilities at the National Bureau of Standards that pertain to solar collectors and the instrumentation required to evaluate their performance. Alternative methods are also briefly described for obtaining the quantified assurance that the pertinent flow measurements are as good as they are quoted to be. Flow-metering problem areas are also discussed with suggestions for preventative or remedial action.

44077 (PB—85-199255/XAB) Large-scale solar heating technology: Ingelstad - a solar group heating plant without heat pumps. Jilar, T. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 259p. (D—2:1985). NTIS, PC E11/MF E01.

When it started in 1979, the group solar heating plant in Ingelstad was the first pure large-scale solar heating installation in Sweden. Although it was built to provide some of the heating requirements of a residential area, its real purpose was to contribute to the development of solar heating technology. It provided new scope for comprehensive and precise investigation of system design and energy performance aspects. The work included comprehensive measurement of performance, primarily during the 1981 and 1982 operating seasons.

44078 (PB—85-217339/XAB) Revisions included in HUD Intermediate Minimum Property Standards Supplement 4930.2, 1977 edition: solar heating and domestic hot-water systems. (National Bureau of Standards, Washington, DC (USA). Solar Energy Program). Apr 1984. 104p. NTIS, PC A06/MF A01.

This addendum to a 1977 HUD publication contains revisions and additions to the existing intermediate minimum property standards supplment for solar heating and cooling systems. Building design revisions cover fire protection, penetrations, and roof coverings. Changes to guidelines for materials, such as those for thermal and ultraviolet stability and moisture resistance, are detailed. Flash points of toxic and combustive fluids, chemical and physical compatibility, and flame spread and resistance of insulation materials are also explained. Construction standards were revised for hail loads; waterproofing insulated exterior storage containers, pipes, and ducts; and for passive systems. Standards also were revised for power-operated protection, dust and dirt prevention, and chimney and vent heights. Radiation temperature, draft control, and thermal energy storage and loss standards were deleted. Other standards for insulation values for thermal devices, lighting protection, and sealing and testing air distribution systems were added. Appended materials contain revisions to calculation procedures for determining the thermal performance of active, solar space heating, and domestic hot water systems. A revised materials list for properties of typical cover materials, absorptive coatings, thermal storage unit containers, and heat-transfer liquids is provided. Revisions to acceptable engineering practice standards are also included.

44079 (SERI/TP—253-2435) Variable-base degree-day correction factors for energy savings calculations. Wortman, D.N.; Christensen, C.B. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1985. Contract AC02-83CH10093. 11p. (CONF-850123—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012164.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Chicago, IL, USA (27 Jan 1985).

Heating degree-days are often used as a climatic measure in building energy calculations. To account for the effects of solar and internal gains, degree-days at a base temperature, lower than the heating set point temperatures are used, or the number of degree days is adjusted downward by a degree-day correction factor. In this paper, we present a theoretical derivation, which demonstrates that ASHRAE C/sub d/ factors are not the appropriate correction factors for the calculation of energy savings from envelope conservation measures. The results of this derivation can be used to develop new correction factors appropriate for savings calculations.

1410 Solar Collectors And Concentrators

44080 (CONF-801197—, pp 65-68) **Solar heat pond system.** Kreul, B. (Howard County Farm Bureau, Nashville, AR). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Described is the construction of a prototype solar collector, which is called a "Solar Heat Pond System". It consists of 150-square foot flat surface collector with a reflectig cover. We're using 3000 gallons of water as the heat storage mass. We're building the thing with off-the-shelf materials we're getting locally in town and through some catalogues. The construction is very simple; we're doing it ourselves. The technology is also very simple. In this small system, we expect to be able to collect, store and utilize approximately 26 million Btu's during the winter months.

44081 **(DGRST—80-7-0125) Development of an air solar collector. Compared balances of air and water systems.** Berge, R.; Brunet, S.; Coudert, J.P.; Hammou, A.; Oliva, J. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1982. 435p. (In French). NTIS (US Sales Only), PC A19/MF A01. File Number DE85751282.

A porous-absorber air solar collector is developed: different materials which are currently available and inexpensive, leading to the choice of a reticulated plastic foam are tested. One studies by simulation in the conditions of Perpignan, the comparative balances of an air system and a water system for the production of hot air for use in heating. Measurement of the performance of the two systems in the experimental building constructed by the Applied Physics Laboratory at the University of Perpignan are finally presented.

44082 **(DOE/AL/04266—T2) Microstructural and mechanical property evaluation of solar collectors. Final report.** Inal, O.T. (New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Metallurgical and Materials Engineering). 1 Jun 1985. Contract AS04-78AL04266. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017038.

The overall contributions of the program can be divided into three major areas: (1) nucleation and growth studies of adatom layers through transmission electron microscopy, reflection electron diffraction, and field-ion microscopy techniques; (2) electrodeposition parameter optimization studies for the production of photothermal collector surfaces made in terms of the as plated as well as thermally degraded microstructures; and (3) the thermal degradation mechanisms that emanate from structural alterations were optically modelled for the coatings produced in (2). These three topics are individually summarized.

44083 **(DOE/EIA—0174(84)) Solar collector manufacturing activity, 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Aug 1985. 62p. NTIS, PC A04/MF A01 - GPO; GPO Dep. File Number DE85016470.

Producer shipments and end-use data from manufacturers of solar thermal collectors and photovoltaic modules are presented for each year from 1981 through 1984. Data for solar thermal collectors are shown by company headquarters location, collector type (low-temperature, medium-temperature, special, and other), end use (domestic hot water heating, pool heating, space heating and cooling, industrial and agricultural processing, and other), and market sector (residential, commercial, industrial, agricultural, and other). Also reported are imports, exports, related activities, and prototype development. Photovoltaic module data shown are market sector, end use, and exports. Appendixes provide Form EIA-63, describe its history and methodology, and list manufacturers responding to the survey. 3 figs., 16 tabs.

44084 **(EUR—9142-EN) Italian solar pilot test facility.** Grassi, L. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 160p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report deals with the second phase of the work programme provided for by contract No. ESA-T-109-I(S) that the European Economic Community signed with ENEL (National Board for Electric Energy) and Phoebus: the period involved stretches from October 1981 to June 1983. After a brief history of the SPTF project, the report describes the operations performed, which are mainly: system configuration and software modifications, operational check procedures, calibration of various instruments, system parameters measurement, data production and storage. The system behaviour studies are then presented, with an analysis of the results obtained in various Solar System 1 and Solar System 2 configurations; furthermore, a chapter is devoted to the description of the links between the Pilot Test Facility group and the European modelling group, and examples are given of model validation work. Finally, conclusion are drawn from the work so far carried out and recommendations are made for the future work.

44085 **(EUR—9233-EN) Irish solar pilot test facility.** Cowan, I.J. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 198p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report deals with the final operational phase of the Solar Pilot Test Facility under contract number ESA-T-006 EIR(B) between the Institute for Industrial Research and Standards and the Commission of the European Communities. The final operational phase coincides with the last contractual period of the current four years' programme, and covers the period October 1981 to June 1983 inclusive. It is therefore related to the two previous phases - encompassing March 1978 to June 1979, and October 1979 to September 1981 - details of which are given in the relevant reports for these phases. The history of work in the project, together with items of the work done for the last two heating seasons are discussed. Operation of the Solar Pilot Test Facility is described, including measurement and control problems associated with production and storage of data. System behaviour studies for both solar sub-systems are discussed, including parametric studies and work undertaken in concert with the other project participants. The use of the test results for model validation is considered, and the relationship between the programmes of the Solar Pilot Test Facilityu and European Modelling Group is discussed. Finally, conclusions are drawn, and recommendations made for further work in this field of research and development.

44086 **(EUR—9282-EN) European modelling group.** Reichert, J.; Schlag, D. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 138p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The report describes the work of the German participant of the European Modelling Group (EMG) carried out under research contract No. ESA-M-114-D. The objectives of the programme of the European Modelling Group over the period from July 1981 to June 1983 were: Development of a detailed simulation programme for solar systems. The programme should be as flexible as possible and capable of simulating a large variety of solar systems. - Validation of the model with the aid of experimental data from the European Solar Pilot Test Facilities; - carrying out system studies with the model; - development of a European simplified method and validation of the simplified method with the aid of the detailed model. After development of the first version of the model by the coordinator, work on validation, system studies, and extension of the model was shared by the participants of the group. Validation results revealed that the limiting factor is the uncertainty of available data from the Solar Pilot Test Facilities. It was, therefore, neither necessary nor possible to improve the physical or mathematical accuracy of the model. System studies showed the flexibility of the

model for applications with various solar systems and delivered valuable data on system performance under different climatic conditions. After testing some existing simplified methods, a new European simplified method was developed and validated against the detailed model. This method proved more accurate than other existing methods for computing monthly and yearly performance data.

44087 **(FRNC-TH—1567) Concentrating systems in photovoltaic conversion. Achievements and forecastings.** Laurent, B. (Toulouse-3 Univ., 31 (France)). 1982. 178p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85750551.

The place of concentrating systems in the field of current research on photovoltaic conversion is reviewed. Two experiments with concentrating systems by Fresnel lenses are described and analysed. Sophocle 100W and Sophocle 500W. A comparison with solar panels without concentrating systems enables development prospects of the Sophocle system to be clarified.

44088 **(FRNC-TH—1595) Contribution to the theoretical and experimental study of solar photochemical reactors.** Duprat, F. (Aix-Marseille-3 Univ., 13 - Marseille (France)). 1982. 168p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750695.

In this work solar photoreactors are simulated and the validity of the model is tested by an experimental study. The solar collector is made of a conical mirror with an angle of $\pi/2$. The tubular reactor (cylinder or ring) is placed on the axis. Laminar, turbulent and real flow are studied. Influence of the variations of solar radiation intensity on conversion rate is examined. Experiments are carried out with a 1 m^2 mirror and a water cooled cylindrical reactor of 0.5 liter. The photochemical reaction used is sodium dodecybenzene sulfonate decomposition sensitized by ferric chlorate. Reaction kinetics are measured for different flow rates and different light intensities.

44089 **(FRNC-TH—1911) Dynamic behaviour of flat-plate solar collectors.** Kabalan, B. (Lyon-1 Univ., 69 - Villeurbanne (France)). 1983. 144p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751277.

Equations of heat exchange in a collector are formulated. The notion of thermal inertia applied to collector is specified and the practical method of determining this is presented. Operating equations for solar collectors in the transient regime are established and verified on the basis of a simplified model.

44090 **(FRNC-TH—1978) Properties of amorphous carbon thin films deposited by magnetron pulverization. Application to selective surface for in-vacuum absorbers.** Wyon, C. (Institut National Polytechnique, 38 - Grenoble (France)). 1984. 170p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752372.

In view of development of an efficient selective surface for solar absorber with steady performances in vacuum at temperatures over 400°C, preparation and properties of a metal-amorphous carbon stacking have been studied. Examination of non reactive magnetron pulverization of a graphite target reveals the specific spectral selectivity of carbon films. These films are of amorphous semiconductor type and their macroscopic, structural, optical and electrical properties are largely influenced by a modification in the deposition operating conditions.

44091 **(LBL—19102) Solar radiant processing of gas-particle systems for producing useful fuels and chemicals.** Hunt, A.J.; Ayer, J.; Hull, P.; Miller, F.; Russo, R.; Yuen, W. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 9p. (CONF-850810—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016550.

From National heat transfer conference; Denver, CO, USA (4 Aug 1985).

This paper reviews the research program at LBL studying direct radiant heating for the production of fuels and chemicals. The research is investigating the use of gas-particle suspensions to absorb concentrated sunlight to supply energy for endothermic chemical reactions. The goal of the research is to understand the optical, thermodynamic, and chemical processes in solar heated particle suspensions through a balanced program of analytical and experimental investigations. The use of small particles as solar absorbers is discussed and spectral extinction efficiencies are calculated from Mie theory for various particle sizes. An equation for calculating the heat transfer from a particle to the surrounding gas at arbitrary Knudsen number is developed. The experimental section outlines the current laboratory studies of direct radiant heating that utilizes a high intensity radiant source to simulate concentrated sunlight. Some preliminary experimental results are presented.

44092 **(LBL—19842) Direct radiant heating of particle suspensions for the production of fuels and chemicals using concentrated sunlight.** Hunt, A.J.; Ayer, J.; Hull, P.; Miller, F.; Russo, R.; Yuen, W. (Lawrence Berkeley Lab., CA (USA); California Univ., Santa Barbara (USA). Dept. of Mechanical and Environmental Engineering). Jun 1985. Contract AC03-76SF00098. 9p. (CONF-850604—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016548.

From INTERSOL '85 - Solar energy--the diverse solution; Montreal, Canada (23 Jun 1985).

This paper describes recent advances in the research program at LBL to understand the behavior of radiantly heated gas-particle suspensions. The research is investigating the use of gas-particle suspensions to absorb concentrated sunlight to supply energy for endothermic chemical reactions. The analytical section includes the description of a chemical survey, the results of optical calculations, and a summary of heat transfer studies. The experimental section outlines the current laboratory studies of direct radiant heating that utilize a high intensity radiant source to simulate concentrated sunlight. This work is aimed at establishing a technology base supporting new applications of concentrated sunlight for the production of useful fuels and chemicals.

44093 **(NBSIR—85-3197) Molecular and microstructural factors affecting mechanical properties of polymeric cover plate materials.** Clark, E.J. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1985. Contract AI01-76PR06010. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016820.

This paper reviews the dependence of mechanical properties of polymers on various microstructural factors. The microstructural and molecular factors considered are: molecular weight, crystallinity, crosslinking, branching, copolymerization, plasticization, orientation, and residual stresses. The types of mechanical properties considered are: direct loading, fatigue, creep, wear and abrasion, and environmental stress cracking. The effects of polymer deformation and fraction at the molecular level are discussed. Cracking, crazing, and shear yielding are described. Polymeric cover plate materials are discussed and their degradation reviewed. Methods to measure microlevel changes in polymers are identified.

44094 **(PB—85-193167/XAB) Development of flat-plate solar collector-evaporator. Report for 11 January 1980-31 March 1981.** Abramzon, B.; Yaron, I. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Applied Research Inst.). Apr 1981. 61p. NTIS, PC E04/MF E01.

Sponsored by Ministry of Energy and Infrastructure, Tel-Aviv (Israel).

The stage of the project reported herein has been devoted to the elaboration of the simulation model of the flat-plate solar collector-evaporator. Work at this stage was restricted to the analysis of the performance characteristics of a collector-evaporator operating with a single-component fluid, emphasizing the possible utilization of the collector to generate vapors, required to drive a gas turbine. Methods for the calculation of the amount of solar radiation absorbed by the collector's surface, of the coefficient of heat losses from the collector, and of the heat-transfer coefficient in the tubes with possible boiling phenomena are presented in detail. The operation of the simulation program is explained at some length, and some results of the analysis of a flat-plate solar collector-evaporator on the basis of this simulation program are presented.

44096 **(SAND—85-0412C) Optical properties of solid particle receiver materials. I. Angular scattering and extinction characteristics of Norton Masterbeads.** Griffin, J.W.; Stahl, K.A.; Pettit, R.B. (Pacific Northwest Labs., Richland, WA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 39p. (CONF-850887—18). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015494.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

As part of the Solar Thermal Technology Program, the direct absorption of sunlight by free-falling particles inside a cavity receiver is being evaluated. The objective of the ongoing optical properties measurement program is to obtain information to be used as input to radiation transfer models for prediction of receiver performance. Instrumentation and data analysis techniques have been developed to determine both the angular scattering properties and the scattering and absorption components of the extinction coefficient of candidate materials. This report summarizes the measurement procedures and presents data for an iron-doped alumina spheroid, Masterbead, manufactured by Norton Chemical Co. This material exhibits good optical absorption properties over the solar insolation spectrum and favorable thermal and mechanical properties for temperatures up to 1000°C. Scattering and extinction measurements were performed at 632.8 nm in a falling curtain geometry of one-particle nominal thickness. Data were obtained over a range of mass flow rates and particle areal densities. Photographic documentation of curtain particle density enabled calculation of mean particle scattering and absorption loss components in the absence of multiple-particle optical interactions. Prediction of optical extinction properties at other wavelengths is anticipated to be straightforward using spectral hemispherical reflectance measurements on bulk samples. Additional scattering and extinction data were obtained on transparent glass microspheres for comparison and as a verification of the measurement apparatus and procedures.

44098 **(SAND—85-0413C) Optical properties of solid particle receiver materials. II. Diffuse reflectance of Norton Masterbeads at elevated temperatures.** Stahl, K.A.; Griffin, J.W.; Pettit, R.B. (Pacific Northwest Labs., Richland, WA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC06-76RL01830;AC04-76DP00789. 18p. (CONF-850887—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015495.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

An experimental system to measure the diffuse reflectance of a particulate sample over the wavelength range of 300 to 2500 nm and at elevated temperatures up to 1000°C has been developed and implemented. A description of the experimental apparatus and measurement procedures, as well as optical reflectance data for Masterbeads, are presented. Using the high temperature measurement system, the diffuse reflectance of Masterbeads changed by less than 1% for sample temperatures from 150°C to 930°C. However, after heating a sample for 3 hours at 1000°C in air, the solar absorptance measured at room temperature decreased from an initial value of 0.93 to 0.89.

44097 **(SERI/STR—252-2679) User's manual for Massachusetts Institute of Technology Solar Thermal Pond Program (MITSOL).** Atkinson, J.; Adams, E.; Salhotra, A.; Harleman, R. (Massachusetts Inst. of Tech., Cambridge (USA). Ralph M. Parsons Lab. for Water Resources and Hydrodynamics). Jun 1985. Contract AC02-83CH10093. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85012147.

MITSOL (Massachusetts Institute of Technology Solar Pond Model) is a one-dimensional numerical model, written in FORTRAN, that may be used to predict transient vertical temperature and salinity profiles in a salt gradient solar pond. The formulation is based on a mixed-layer approach to modeling the vertical structure of a water body, and uses a finite difference explicit technique to solve basic salt and heat budget equations. A separate algorithm calculates wind-induced entrainment and subsequent deepening of the pond's upper mixed layer (or upper convecting zone). This report includes (1) a discussion of the main program and subroutines and functions, (2) a discussion of the input file and the model's output, (3) a sample test case for the model, (4) the FORTRAN code for the model, and (5) a complete glossary for the code.

44099 **(SERI/STR—252-2722) Entrainment in diffusive thermohaline systems. Application to salt gradient solar ponds.** Atkinson, J.F.; Adams, E.E.; Melville, W.K.; Harleman, D.R.F. (Massachusetts Inst. of Tech., Cambridge (USA). Ralph M. Parsons Lab. for Water Resources and Hydrodynamics). Jul 1985. Contract AC02-83CH10093. 327p. NTIS, PC A15/MF A01; GPO Dep. File Number DE85012161.

This report describes the development of a numerical model for simulating the temporal evolution of vertical temperature and salinity profiles in a salt-gradient solar pond. The model uses a mixed-layer approach, and a general entrainment relation is derived for predicting the growth of the upper mixed layer. One major effort involved studying the process of mixed-layer deepening in a strongly stratified "diffusive" double-diffusive system. In the first of two experiments, a vertically oscillating grid drove interfacial mixing in a two-layer system in which the temperature and salinity differences between the layers were varied. The second experiment addressed wind-induced mixing in a laboratory wind/wave tank. Tests involved several different mean wind speeds and considered two-layer systems with salt or diffusive double-diffusive stratification. No differences could be seen in the results for the two different kinds of stratification. Additional experiments in the wind/wave tank tested the effect of placing floating plastic pipes or netting on the water surface. Results showed that both pipes and netting can effectively reduce wind mixing. Experimental data and data from previous research define suggested values for the coefficients in the entrainment model, which is incorporated into the full numerical simulation model.

44099 **(SERI/TR—252-2322) Review of SERI solar pond work.** Zangrando, F.; Johnson, D.H. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1985. Contract AC02-83CH10093. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85012162.

This report provides documentation of SERI's solar pond research effort, which began in 1979. SERI staff analyzed solar pond topics from modeling and feasibility studies to laboratory experiments on physical properties and hydrodynamical stability. SERI's perspective on the maturity of this solar technology is described, including the technical state of the art of salt-gradient solar ponds, state of knowledge of pond design, estimated cost ranges for various locations and applications, and perceived barriers to commercial development. Recommendations for future work are also presented. SERI research and development on solar ponds is described, emphasizing analytical and experimental tools developed at SERI. All SERI and subcontract reports dealing with solar ponds or related system components are summarized, and a bibliography is provided.

44100 **(SERI/TR—253-2169) Wind loading on solar collectors.** Bhaduri, S.; Murphy, L.M. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85012151.

The present design methodology for the determination of wind loading on the various solar collectors has been reviewed and assessed. The total force coefficients of flat plates of aspect ratios 1.0 and 3.0, respectively, at various angles of attack obtained by using the guidelines of the ANSI A58.1-1982, have been compared with those obtained by using the methodology of the ASCE Task Committee, 1961, and the experimental results of the full-scale test of heliostats by Peglow. The turbulent energy spectra, currently employed in the building code, are compared with those of Kaimal et al., Lumley, and Ponofsky for wind velocities of 20.0 m/s and 40.24 m/s at an elevation of 9.15 m. The longitudinal spectra of the building code overestimates the Kaimal spectra in the frequency range of 0.007 Hz to 0.08 Hz and underestimates beyond the frequency of 0.08 Hz. The peak angles of attack, on the heliostat, stowed in horizontal position, due to turbulent vertical and lateral components of wind velocity, have been estimated by using

Daniel's methodology for three wind velocities and compared with the value suggested by the code. The experimental results of a simple test in the laboratory indicate the feasibility of decreasing the drag forces of the flat plate by reducing the solidity ratio.

1420 Heat Storage

REFER ALSO TO CITATION(S) 44032, 44035, 44036, 44037, 44042, 44043, 44047, 44049, 44051, 44052, 44053, 44055, 44056, 44066, 44444

44101 (EUR—8869) Study of heat storage in non-saturated soils: construction of a column for simulation tests of the behavior of a non saturated strata used as storage zone. Benet, J.C.; Chevassus, D.; Della-Valle, G.; Duruisseaud, P.; Koufogiannis, D.; Saix, C. (Commission of the European Communities, Luxembourg). 1984. 1p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The efficiency of energy storage in a saturated layer is linked to a great extend to energy and matter losses through the non-saturated layer of soil lying above the saturated layer used as a storage zone. In order to study this problem we constructed a physical model of sufficiently large size. A test programme has made it possible to simulate heat storage at 60°C. The surface of the soil was subjected to controlled conditions and then natural atmospheric conditions. The physical model serves as a prototype for the study of the behaviour of a natural site. The evolutions of the physical model make it possible to judge the modifications in the state of the non-saturated layer of soil and to come to conclusions regarding the harmful effects of storage. The physical model has given experimental results that confirm the validity of a local three-phase mathematical model. This confirmation allows this model to be used in the future for making forecasts for other sites.

44102 (EUR—9144-EN) Development and optimisation of cost effective thermal energy storage systems for solar space heating by means of a microprocessor controlled test facility. Cohen, R.R.; Manley, B.J.W.; Bell, M.A.; Wood, R.J. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 291p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report describes the results of three years research into thermal energy stores for active solar space heating. The project had three major aims: 1. Experimental research and development on thermally effective, low cost TES technologies. As a result, the thermal performance of stores under a very wide range of operating conditions is known. 2. Computer modelling of complete solar space heating systems to evaluate the potential improvements in annual solar fraction brought about by specific designs of store, the models being validated by the experimental work. 3. Cost optimisation of solar space heating systems, incorporating annual simulations, to compare the cost effectiveness of specific designs of store over the systems' lifetime and to determine the overall economic viability of active solar space heating.

44103 (FRNC-TH—1563) Numerical methods for heat storage. Iam Ba, M. (Paris-6 Univ., 75 (France)). 1982. 104p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750553.

This thesis deals with the construction of a numerical model enabling the study of the thermal behaviour of a fusible storage element subjected to a heat carrier fluid whose temperature varies sinusoidally, as a function of time.

44104 (FRNC-TH—1903) Heat storage in the grounds, realization of a testing area. Della Valle, G. (Toulouse-3 Univ., 31 (France)). 1982. 239p. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number DE85751274.

The preparation of a physical model of the unsaturated ground layer situated above a water table used as a thermal storage site is described. Physical model specifications and factors considered when selecting a testing site are presented. Six sets of measurements determining the ground conditions are studied. A testing program including the simulation of a thermal storage and the implementation of various conditions at the ground surface is presented. A project including the calculation of heat and mass transfer, the study of nuisances and the comparison with a mathematical model is finally interpreted.

44105 (FRNC-TH—1909) Mixed convection in solar tanks. Zandvliet, D. (Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)). 1982. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85751276.

One deals with physics of the flow of a non isothermal fluid in a closed medium. A finite element method is proposed to resolve the Navier Stokes equations coupled to the temperature field. An application to some cases of loading of a hot water accumulator in order to show the validity and performance of the method is then presented. Mean scale experimental study enabled the visualization of a quasi-two-dimensional isothermal flow. An important turbulence tending to destroy the stratification is pointed out.

44106 (FRNC-TH—1932) Dynamics of latent heat storage in a fixed bed: application to the paraffin impregnated activated carbon. Chapotard, C. (Institut National Polytechnique, 54 - Nancy (France)). 1983. 318p. (In French). NTIS (US Sales Only), PC A14/MF A01. File Number DE85751284.

The first trials concerning the storage of heat on activated carbon impregnated with paraffin carried out at the ELF research centre are described. The possible causes of instability of the material, possible remedies and of adequate porous substrates are studied. The classical model of cascade mixers is employed to simulate the hydrodynamics and the fluid/solid heat exchange. The model is extended in order to include additional effects. Methods for determining and identifying the parameters of this model criteria are proposed for evaluating the overall thermal performance of a divided material.

15 GEOTHERMAL ENERGY

44107 Geothermal Energy Technology: a current awareness bulletin. Raridon, M.H.; Smith, L. (eds.). *Geothermal Energy Technology;* No. 85/3, vp(15 Feb 1985). (PB—85-914703; DOE/GET—85/3).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

This bulletin of abstracts announces on a semimonthly basis the worldwide information available on the technology required for economic recovery of geothermal energy and its eventual utilization. Information is included on the following subjects: resource status and assessment; geology and hydrology; geothermal exploration; legal and institutional aspects; economics and financial aspects; environmental aspects and waste disposal; by-products; geothermal power plants; direct energy utilization; and geothermal data and theory.

1501 Resource Status And Assessment

44108 (BRGM—83-SGN-742-SPG) Reciprocal influence analysis of the geothermal energy exploitation in the Sarcelles (France) region. Coudert, J.M.; Menjoz, A. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Oct 1983. 27p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752381.

The optimization study for the hydrothermal exploitation of the Sarcelles-Garches-Gonesse-Villiers-le-Bel geothermal field by these towns of the Bassin parisien is presented.

44109 (DOE/ET/28407—T6) Water information bulletin No. 30, part 13: geothermal investigations in Idaho. Preliminary geologic reconnaissance of the geothermal occurrences of the Wood River Drainage Area. Anderson, J.E.; Bideganeta, K.; Mitchell, J.C. (Idaho Dept. of Water Resources, Boise (USA)). Apr 1985. Contract AS07-77ET28407. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016972.

Pre-tertiary sediments of the Milligen and Wood River Formations consisting primarily of argillite, quartzite, shale and dolomite are, for the most part, exposed throughout the area and are cut locally by outliers of the Idaho Batholith. At some locations, Tertiary-age Challis Volcanics overlay these formations. Structurally the area is complex with major folding and faulting visible in many exposures. Many of the stream drainages appear to be fault controlled. Hydrologic studies indicate hot spring occurrences are related to major structural trends, as rock permeabilities are generally low. Geochemical studies using stable isotopes of hydrogen and oxygen indicate the thermal water in the Wood River region to be depleted by about 10 0/00 in D and by 1 to 2 0/00 in $^{18}0$ relative to cold water. This suggests the water could be meteoric water that fell during the late Pleistocene. The geological data, as well as the chemical data, indicate the geothermal waters are heated at depth, and subsequently migrate along permeable structural zones. In almost all cases the chemical data suggest slightly different thermal histories and recharge areas for the water issuing from the hot springs. Sustained use of the thermal water at any of the identified springs is probably limited to flow rates approximating the existing spring discharge. 28 refs., 16 figs., 3 tabs.

44110 (DOE/ID/12026—T13) Geothermal resources of the Green River Basin, Wyoming, including thermal data for the Wyoming portion of the Thrust Belt. Spencer, S.A.; Heasler, H.P.; Hinckley, B.S. (Wyoming Univ., Laramie (USA). Dept. of Geology and Geophysics). 1985. Contract FC07-79ID12026. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016970.

The geothermal resources of the Green River basin were investigated. Oil-well bottom-hole temperatures, thermal logs of wells, and heat flow data have been interpreted within a framework of geologic and hydrologic constraints. Basic thermal data, which includes the background thermal gradient and the highest recorded temperature and corresponding depth is tabulated. It was concluded that large areas are underlain by water at temperatures greater than 120°F. Although much of this water is too deep to be economically tapped solely for geothermal use, oil and gas wells presently provide access to this significant geothermal resource. Isolated areas with high temperature gradients exist. These areas - many revealed by hot springs - represent geothermal systems which might presently be developed economically. 34 refs., 11 figs., 8 tabs. (ACR)

44111 (DOE/ID/12026—T14) Geothermal resources of the Wind River Basin, Wyoming. Hinckley, B.S.; Heasler, H.P. (Wyoming Univ., Laramie (USA). Dept. of Geology and Geophysics). 1985. Contract FC07-79ID12026. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016969.

The geothermal resources of the Wind River Basin were investigated. Oil-well bottom-hole temperatures, thermal logs of wells, and heat flow data have been interpreted within a framework of geologic and hydrologic constraints. Basic thermal data, which includes the background thermal gradient and the highest recorded temperature and corresponding depth for each basin, is tabulated. Background heat flow in the Wind River Basin is generally insufficient to produce high conductive gradients. Only where hydrologic systems re-distribute heat through mass movement of water will high temperatures occur at shallow depths. Aquifers which may have the confinement and structural characteristics necessary to create such geothermal systems are the Lance/Fort Union, Mesa Verde, Frontier, Muddy, Cloverly, Sundance, Nugget, Park City, Tensleep, Amsden, Madison, Bighorn, and Flathead Formations. Of these the Tensleep Sandstone and Madison Limestone are the most attractive in terms of both productivity and water quality. Most of the identified geothermal anomalies in the Wind River Basin occur along complex structures in the southwest and south. The most attractive geothermal prospects identified are anomalous Areas 2 and 3 north of Lander, Sweetwater Station Springs west of Jeffrey City, and the thermal springs southwest of Dubois. Even in these areas, it is unlikely temperatures in excess of 130 to 150°F can be developed. 16 refs., 7 figs., 7 tabs. (ACR)

1502 Geology And Hydrology Of Geothermal Systems

44112 (BRGM—84-SGN-79-GTH-IRG) Analysis of the natural water flows in the geothermal aquifer of the Bassin de Paris dogger. Aubertin, G.; Ballin, F. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Feb 1984. 36p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752364.

Also contains maps.

The results of the natural water flow in the geothermal aquifers in the dogger of Bassin de Paris are presented. Maps of potentiometric levels have been established with the pressure measurements realized in the geothermal drillings.

44113 (BRGM—84-SGN-144-IRG-GTH) Geothermal resources of medium temperature. Study of type regions. Gadalia, A.; Rancon, J.P. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Apr 1984. 77p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752380.

The geothermal resources of temperature between 70°C and 150°C contained in different geologic structures (recent grabens, deep faults and volcanic zones, geologic deposits) are reviewed in France, Thailand, Greece, Turkey.

44114 (BRGM—84-SGN-149-IRG) Hydrothermal mineralization and geochemical balance of fossil geothermal fields: preliminary study on two fields in Martinique and Lesser Antilles. Escalan, M. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1984. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752383.

The experimental results of the study on the mineralogical and geochemical transformations by rock-fluid interactions in the fossil geothermal reservoir in Martinique are presented: macroscopical and microscopical studies, mineralogical analysis by electronic microprobe, chemical analysis.

44115 (SAND—84-0288, pp 46-50) **Problems to be addressed by intermediate depth drilling in Long Valley Caldera.** Hermance, J.F. (Brown Univ., Providence, RI). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44116 (SAND—84-0288, pp 59-61) **Permeability determination from injection test data.** Bodvarsson, G.S. (Univ. of California, Berkeley). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 44109, 44110, 44111

44117 (BRGM—83-SGN-578-IRG) Description and directions for use of the IAO computer code for the data processing of the geothermal drilling test. Version 1.0 for the R2E MICRAL 21D system. Menjoz, A. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Aug 1983. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752379.

The I.A.O. computer codes for the exploitation of the repeating test data on the well drilling are presented.

44118 (BRGM—84-SGN-090-GTH) Further diagraphies on the Aulnay-sous-Bois (GAY 4) drilling for the exploration of the Albian, Neo-comian and Lusitanian aquiferous strata. Aubertin, G.; Ballin, F. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Feb 1984. 13p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752363.

Also contains maps.

This report presents the complementary results of the diagraphic study on the Aulnay-sous-Bois (France) geothermal field: measurements of porosity and permeability of the rocks by neutron, gamma and sonic diagraphy.

44119 (BRGM—84-SGN-141-IRG) Geothermal drillings in the Dogger of Aulnay-sous-Bois and Blanc-Mesnil Nord (France)). Giot, D.; Rojas, J.; Bonijoly, D.; Fouillac, A.M.; Monciardini, C.; Robelin, C.; Sureau, J.F.; Amieux, P. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1984. 67p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752382.

This report presents the results of the studies on the sedimentology and diagraphy of the reservoir and specially the productive levels, a best understanding of the diagenesis phenomena and their consequences on the evolution of the porous system, the connection between porous height and productive height, the well to well geological correlations to elaborate a hydrodynamic model of the reservoir relative to the sedimentation, diagenesis and fracturation.

44120 (BRGM—84-SGN-159-SPG) DST tests in geothermal exploration. Maget, P. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). May 1984. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752378.

The drill stem testing (DST) generally employed in petroleum exploration is applied here in the study of the geothermal fields in France (for exemple the Bassin parisien Dogger). The results are satisfying.

44121 (DOE/ID/12172—T2) Monitoring temperature conditions in recently drilled nonproductive industry boreholes in Oklahoma. Harrison, W.E.; Luza, K.V. (Oklahoma Geological Survey, Norman (USA)). Jun 1985. Contract AS07-80ID12172. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017034.

Temperature conditions were monitored in seven industry petroleum-test wells (called holes-of-opportunity in this report) that were drilled in central and eastern Oklahoma. Five of these wells provided useful temperature information, and two wells were used to determine the length of time needed for the borehole-fluid temperature to achieve thermal equilibrium with the formation rocks. Four wells were used to verify the validity of a geothermal-gradient map of Oklahoma. Temperature surveys in two wells indicated a gradient lower than the predicted gradients on the geothermal-gradient map. When deep temperature data, between 5000 and 13,000 feet, are adjusted for mud-circulation effects, the adjusted gradients approximate the gradients on the geothermal-gradient map. The temperature-confirmation program appears to substantiate the geographic distribution of the high- and low-thermal-gradient regimes in Oklahoma. 13 refs., 18 figs., 7 tabs.

44122 (SAND—84-0288, pp 79-82) Borehole microseismic measurements for CSDP. Dennis, B.R.; Albright, J.N.; Keppler, H. (Los Alamos National Lab., NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44123 (SAND—84-0288, pp 117) Downhole periodic seismic sources. Hardee, H.C. (Sandia National Labs., Albuquerque, NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44124 (SAND—84-0288, pp 72-74) State-of-the-art: high-temperature logging. Traeger, R.K. (Sandia National Labs., Albuquerque, NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—). Contract AC04-76DP00789.

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44125 (SAND—84-0288, pp 99-100) Research opportunity, Salton Sea Scientific Drilling Project. Becker, K.; Elders, W.A.; Cohen, L.H. (Univ. of California, San Diego). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44126 (SAND—84-0288, pp 111-114) High-temperature borehole instrumentation. Dennis, B.R. (Los Alamos National Lab., NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

44127 (BRGM—84-SGN-023-GTH-Pt.1) Exploration of high energy geothermal sources in the region of Cezallier (Massif Central, France). Magnetotelluric report. Puvilland, P.; Aucel, M.; Dupis, A. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Jan 1984. 95p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752366.

Results of the audiomagnetotelluric and low frequency magnetotelluric measurements on the geothermal field of Cezallier (France) are presented.

44128 (BRGM—84-SGN-023-GTH-Pt.2) Exploration of high energy geothermal sources in the region of Cezallier (Massif Central, France): gravimetric report. Puvillant, P.; Aucel, M. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Jan 1984. 36p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752367.

Results of the gravimetric measurements on the geothermal field of Cezallier (France) are presented.

44129 (BRGM—84-SGN-023-GTH-Pt.3) Exploration of high energy geothermal sources in the region of Cezallier (Massif Central, France). Study of the gases in the soils. Baubron, J.C. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Jan 1984. 15p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752368.

Results of the gas measurements (He and CO_2) in the geothermal field of Cezallier (France) are presented.

44130 (BRGM—84-SGN-023-GTH-Pt.4) Exploration of high energy geothermal sources in the region of Cezallier (Massif Central, France): concluding report. Demange, J.; Puvilland, P.; Aucel, M. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Jan 1984. 29p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752369.

Also contains maps.

The summary and concluding remarks on the measurements on the geothermal sources of Cezallier (France) are presented.

1504 Legal And Institutional Aspects

44131 (CONF-850801—42) How CEQA has streamlined the NEPA process for the DOE Geothermal Loan Guaranty Program. Reed, A.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016320.

From International symposium on geothermal energy; Kailua Kona, HI, USA (26 Aug 1985).

Geothermal loan guaranties have been granted for nine projects located in the western United States, most of them in California where certain state and/or local agency actions are subject to environmental review under the California Environmental Quality Act (CEQA) of 1970. Similarly, the federal action of granting a geothermal loan guaranty must be reviewed pursuant to the National Environmental Policy Act (NEPA) of 1969 to determine its impacts to the quality of the human environment. This paper traces the evolution of the relationship between the CEQA and NEPA environmental review processes, and focuses on the manner in which CEQA has streamlined the NEPA review for the DOE geothermal loan guaranty program. Two recently-prepared DOE environmental assessments are highlighted to describe the incorporation of CEQA analyses and documents into NEPA documents. 7 refs., 1 tab.

1507 By-products

REFER ALSO TO CITATION(S) 44137

1508 Geothermal Power Plants

44132 (DGRST—82-D-0061) Study and achievement of a demonstration model of a liquid/liquid plate heat exchanger with a new configuration and corrosion resistant plastic plates. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1983. 23p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751281.

The aim of the research was the study, the development of the technology, and the construction of a liquid/liquid plate heat exchanger. The study consisted of: 1) The design and dimensioning of the heat exchanger elements, taking account of the thermal exchanges, the load losses and the mechanical constraints; 2) the study of the technology for constructing the plates and for their assembly, by means of small 9 cm x 14 cm models. This enabled a production technique to be established which consisted of hot compression of powder in a mould and joints integrated in the edge of the plates; 3) the construction and laboratory testing of a model exchanger having an exchange surface of about 10 m^2 for which we specified square plates of 45 cm side and including 4 mm x 2 mm water channels. A thermal exchange power of 22 kW was measured with a mean logarithmic temperature bias of 5.12°C, which corresponds to an application in the field of geothermal energy. The load loss was 0.5 bar for a flow rate of 1000 l/h.

44133 (DOE/ID/01523—T2) Manual for the thermal and hydraulic design of direct contact spray columns for use in extracting heat from geothermal brines. Jacobs, H.R. (Pennsylvania State Univ., University Park (USA). Dept. of Mechanical Engineering). Jun 1985. Contract AS07-76ID01523. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015358.

This report outlines the current methods being used in the thermal and hydraulic design of spray column type, direct contact heat exchangers. It provides appropriate referenced equations for both preliminary design and detailed performance. The design methods are primarily empirical and are applicable for us in the design of such units for geothermal application and for application with solar ponds. Methods for design, for both preheater and boiler sections of the primary heat exchangers, for direct contact binary powers plants are included. 23 refs., 8 figs.

44134 (EPRI-AP—4198) Wellhead-sized binary-cycle geothermal power plants. Final report. Linam, P.A.; Norman, W.M.; Outten, T.W.; Tanner, A.L. (Fluor Engineers, Inc., Irvine, CA (USA)). Aug 1985. 403p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920854.

Conceptual designs and estimates of capital costs as well as operating and maintenance costs were developed for wellhead binary-cycle geothermal power plants. Known geothermal resources were characterized, and three were selected as typical of the geothermal resources most likely to be developed for utility use within the next decade. Two wellhead power plant sizes were evaluated for each resource, resulting in six cases. Ten wellhead power plants were considered for the full development of a geothermal resource field. Prefabrication of modules containing portions of the facility was evaluated and included in the design where appropriate. The design development and cost estimates were based on mature technology indicative of the 5th to 10th plant installation to eliminate first-of-a-kind engineering and development costs. Estimates of the cost of elecricity were developed for each case. The sensitivity of the cost of electricity was examined for a number of variables. At brine costs of about $1 per million Btu, one of the plants was judged to be competitive. 50 figs., 76 tabs.

1509 Geothermal Engineering

44135 (BRGM—84-SGN-121-IRG) Program of corrosion study in geothermy. Daumas, S.; Iundt, F.; Lombard, R. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1984. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752365.

Also contains maps.

Program for the study of the corrosion in geothermal plants is presented: chemical and bacteriological study.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 45289

44138 (EPRI-AP—4214) Theory on trace arsenic in geothermal fluids. Final report. Cobble, J.W. (Cobble (James W.), La Jolla, CA (USA)). Aug 1985. 65p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920853.

A chemical equilibrium model has been used to determine the transport of arsenic from a geothermal reservoir throughout a typical geothermal plant. As_2S_3, orpiment, and As_4S_4, realgar, appear to be the minerals which control arsenic solubility in the reservoir and plant, and the principle soluble form in the fluid is arsenous acid, H_3AsO_3. The thermodynamic calculations indicate a soluble arsenic concentration in a 30 ppM H_2S geothermal brine of 91 ppM at 300°C. Other H_2S concentrations will give different H_3AsO_3 concentrations. A number of arsenic species that might vaporize into steam were examined including AsH_3, $AsCl_3$, As_4O_6, and As_4. In the range of brine concentrations and pH values encountered in most geothermal fluids, none of these compounds can contribute detectable levels of gaseous arsenic. However, it is predicted that arsenous acid (like gaseous boric acid) will be soluble at the parts per billion to parts per trillion level in geothermal steam. Such predictions should be verified by experimental determination of gaseous H_3AsO_3 distribution coefficients. Arsenic concentrations and release rates have been calculated at a number of locations in a model geothermal plant including the well head, separator, turbine, and cooling tower. The transport of arsenic in geothermal steam leaving the separator is quite sensitive to the purity of the steam. 11 refs., 4 figs., 21 tabs.

44137 Chemical analyses of geothermal waters and Strategic Petroleum Reserve brines for metals of economic importance. Harrar, J.E.; Raber, E. (Lawrence Livermore National Lab., CA). *Geothermics;* 13: No. 4, 349-360(1984). Contract W-7405-ENG-48.

Waters from seven hydrothermal-geothermal, one geopressured-geothermal, and six Strategic Petroleum Reserve wells have

been surveyed for 12 metals of economic importance using trace chemical analysis techniques. The elements sought were Cr, Co, Mn, Ta, Sn, V, Nb, Li, Sr, Pt, Au and Ag. Platinum was found at a concentration of ~ 50 ppb in a brine from the Salton Sea geothermal area. Brine from this region, as has been known from previous studies, is also rich in Li, Sr and Mn. Higher concentrations (~ 900 ppm) of Sr are found in the high-salinity geopressured brines. None of the fluids contained interesting concentrations of the other metals. Good recovery of precious metals at sub-ppm concentrations from synthetic high salinity brines was achieved using Amborane reductive resin, but similar recovery in the laboratory using real brines could not be demonstrated. Several analytical techniques were compared in sensitivity for the determination of the precious metals; neutron activation analysis with carrier separation is the best for gold and platinum in geothermal brines. 26 references, 7 tables.

17 WIND ENERGY

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 44601, 44690

44138 **(CEA-CONF—7783) Development of vertical axis wind turbines Darrieus type, 5m diameter, at Grenoble (France).** Perroud, P.; Bertrand, G.; Salanon, J.M.; Terrier, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Oct 1984. 8p. (CONF-841071—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752377.

From European wind energy conference and exhibition; Hamburg, F.R. Germany (23 Oct 1984).

The Centre d'Etudes Nucleaires de Grenoble (France) has constructed nine Vertical Axis Wind Turbines (VAWT), of Darrieus type, 5 m diameter (D5), in order to acquire a wide knowledge of this kind of wind turbines and of its performances, the final goal being the construction of larger VAWT, in the range of hundreds kW. All these machines have in common a classical Darrieus rotor (2 or 3 bladed), H/D = 1, troposkian shape. Several conversion systems have been studied and tested, using electrical DC and AC generators ranging from 3.5 kW to 10 kW and working either at variable speed or at constant speed: connection to a power grid, battery charging, electrical heating and direct thermo-mechanical heating. Five of these machines are being tested in different places: Centre National d'Essais Eoliens de Lannion, Centre Scientifique et Technique du Batiment de Nantes, and Centre Regional d'Essais Eoliens en Milieu Montagnard, Croix de Chamrousse (Isere). At this latter place, where cold climate conditions are encountered (altitude 2250 m), four machines are in operation, three HAWT of AEROWATT Co (3.2 m and 7 m diameter) and one VAWT (5 m diameter). A 10 m diameter VAWT (30 kWe) equipped with two induction generators, is in construction and a 25 m diameter VAWT (350 kWe) is planned for 1985, in cooperation with NEYRPIC Co of Grenoble.

44139 (CONF-801197—, pp 130-149) **Let's cash crop the fence row and the water flow.** Schneider, D.J.; Miller, E.M. (Schneider Lift Translator Co.). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The availability of the natural resources that are the fuels for conversion into power such as the masses of low-velocity fluids flowing in our atmosphere, namely wind, and in our hydrosphere, namely water, is discussed. The primary problems associated with the conversion and use of this energy in the case of both wind and low-head water is the fact that these natural resources occur at relatively low velocities. Discussed is the Schneider Engine technology; how they are meeting the challenge to develop these two renewable resources; and how the utilization of this equipment can be a boon to the farming community. Discussion will alternate between the two resources - wind and water. The technology is applicable in both, being built in a configuration applicable to the specific driving medium. Wind application is discussed first, and then information on their first low-head hydropower plant installed in a canal check-drop in the Richvale Irrigation District system in Northern California. The harvesting of this power asset is the right of the farmer and rancher. The sale of this harvested power can, and should, be the business of the rancher or farmer. The reasons why they are not harvesting this cash crop is, in part, due to unawareness, to the consequence of available technology, to lack of governmental facilitating factors, to costs, to lack of a means of organization, to lack of a means to market, and to constraints on the part of the local power utility. Discussed are the ways in which many of these factors are beginning to be resolved. The areas that remain in need of the greatest attention toward making the harvesting of wind and low-head waterpower a feasible business reality are the problems associated with choice of technology, costs, marketing attitude and organization for development. 4 figs., 2 tabs.

44140 **(DOE/NASA—0200-1) MOD-5B Wind Turbine System concept and preliminary design report. Volume I. Executive summary.** (Boeing Engineering and Construction Co., Seattle, WA (USA)). Sep 1982. Contract AI01-76ET20320;AI01-79ET23139. 31p. (NASA-CR—168046). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017168.

This report documents the configuration development and performance of the MOD-5B Wind Turbine System. The MOD-5B WTS project is a continuation of DOE programs to develop and achieve early commercialization of wind energy. The MOD-5B is design optimized for commercial production rates which, in multi-unit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than 3.75 cents per kilowatt hour based on 1980 dollars. This report is the Volume I Executive Summary. The full report includes Volume II, Detailed Report (NASA CR-168047, DOE/NASA/0200-2).

44141 **(DOE/NASA—0200-2) MOD-5B Wind Turbine System concept and preliminary design report. Volume II. Detailed report.** (Boeing Engineering and Construction Co., Seattle, WA (USA)). Sep 1982. Contract AI01-76ET20320;AI01-79ET23139. 210p. (NASA-CR—168047). NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85017169.

This report documents the configuration development and performance of the MOD-5B Wind Turbine System. The MOD-5B WTS project is a continuation of DOE programs to develop and achieve early commercialization of wind energy. The MOD-5B is design optimized for commercial production rates which, in multi-unit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than 3.75 cents per kilowatt hour based on 1980 dollars. This report is the Volume II Detailed Report. The full report includes Volume I, Executive Summary (NASA CR-168046, DOE/NASA/0200-1).

44142 **(DOE/R3/06062—T1) Modification of a rotary or translational wind generator to increase its efficiency. Draft final report.** Lois, L. (Lois (Lambros), Bethesda, MD (USA)). Aug 1981. Contract FG43-79R306062. 102p. NTIS MF A01; 2; GPO Dep. File Number DE85009213.

The work reported herein relates to the construction, testing and analysis of a wind generator to test and verify an improvement of its aerodynamic efficiency. The improvement is based on the principle that the interposition of spring between the rotor and the shaft. The purpose of this spring is to store potential energy by allowing the rotor to increase momentarily its angular velocity and extract more energy from the gust structure of the wind. A kW wind energy machine has been installed with the necessary instrumentation. The measurements and the analysis of the problem show it is possible to extract more energy from the gusts in the wind and the simple arrangement of a spring is subject to oscillations. These oscillations can be minimized or eliminated with the use of rotating masses which also act as energy storage devices. This arrangement is shown in the report.

44143 **(DTH-ABK-S—8243) Fatigue tests of wing root section for Nibe Windmill B.** (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner). 1984. 35p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752502.

This report contains results from the tests with the root section, after it has been loaded with bending 1,2 . 10^7 times a level of +-160kNm. Further more the report contains results from a test element of wooden bolt type, where the glue is a cold curing Epoxy paste of the type Redux 410. Finally the report contains a comparing of the previous used Epoxy glue Araldit AW139/ HV998, and the above mentioned Redux 410.

44144 **(DTH-AFM—83-04) CBEAM4. Calculation of eigen oscillations etc. for centrifugally loaded beams.** Oeye, S. (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik). Aug 1983. 49p. (In Danish). Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik.

CBEAM4 is an element program for calculation of eigen-oscillations and -frequencies for centrifugally loaded beams, for instance slender propeller blades or windmill blades.

44145 **(DTH-AFM—83-06) Calculation of trajectories and throw-lengths for torn-off windmill blades.** Noerkaer Soerensen, J. (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik). Nov 1983. vp. (In Danish). Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik.

An aerodynamic and parametric study of trajectories and throw-lengths for torn-off windmill blades is accomplised. The aerodynamic investigation comprehends determination of relevant static profile data, deriving an expression for correction of nonstationary effects based on frame linear theory and autorotation problems. Parameter investigation comprehends checking of trajectory sensitivity to changes in the applied aerodynamics and as weel sensitivity to the conditions of wing tearing-off. Trajectories for torn-off windmill wings are compared for varying tear-off position, inclination, wind velocity and tip velocity. The calculations are done for a windmill model with rotor diameter 15 m, with rotor diameter 40 m (Nibe-windmill dimensions) and with rotor diameter 60 m (Project K dimensions).

44146 **(DTH-AFM—83-07) Risk calculation for personal injuries in a windmill accident in case of a torn-off blade.** Noerkaer Soerensen, J. (Vandkvalitetsinstituttet, Hoersholm (Denmark)). Nov 1983. 53p. (In Danish). Vandkvalitetsinstituttet, Hoersholm (Denmark).

There is described a statistical model estimating the probability of personal injuries in a windmill accident when a blade is torn-off. Probability distribution as function of distance to the windmill is calculated respectively for a Lillemoelle scale with 15 m rotor diameter, a Nibe-scale with 40 m rotor diameter and a Project K scale with 60 m diameter. Calculations are made for a whole wing as well as this wing-piece which has the longest trajectory for each of the mentioned dimensions. Dependence on the rotor tip velocity is considered.

44147 **(EPRI-AP—3963) Wind power stations: 1984 survey. Final report.** Dickson, E.M.; McKeller, M.F.; Finch, D.B. (Strategies Unlimited, Mountain View, CA (USA)). Jun 1985. 164p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920830.

In 1983 and 1984, the amount of electricity produced by commercial wind power stations increased significantly. Development trends identified in this survey, plus statistical information on 105 wind power stations, can be useful to utilities either purchasing electricity from wind power companies or planning their own stations.

44148 **(EUR—8996-EN) Wind energy evaluation for the European Communities.** Musgrove, P. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 143p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Subsequent to the 1973 oil price rises a number of countries initiated substantial wind energy R and D programmes. A wide variety of machines has been built, and some have been developed to competitiveness with other energy generating systems. The report summarizes the developments achieved in EC member states, in the USA, Canada, Japan and Sweden. The main points of interest of the programmes supported by the various countries are explained.

44149 **(FRNC-TH—1904) Investigation into the Darrieus wind turbines. Characteristics and performance of a troposkian in a stream tubes and flow expansion theory.** Harajli, I. (Paris-6 Univ., 75 (France)). 1982. 181p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751275.

A general two-dimensional theory of the Darrieus wind turbine is developed, taking into account in particular the air flow expansion through the machine. This theory is compared with recent multitube theories. A visualisation of the air flow through the wind turbine has been carried out, for different rotational speeds. One studies experimentally the performance of a small Darrieus wind turbine by reducing as much as possible the parasitic frictions of the rotating elements.

44150 **(NP—5752495) Dynamic analysis of wind turbine rotors for lifetime prediction.** Hauge Madsen, P.; Frandsen, S.; Holley, W.E.; Hansen, J.C. (Risoe National Lab., Roskilde (Denmark)). Jul 1983. 202p. NTIS (US Sales Only), PC A10/MF A01. File Number DE85752495.

EFP-80.

A number of sub-models for use in the evaluation of the load-carrying capacity of a wind turbine rotor with respect to short-term strength and material fatigue are presented. The models constitute the theoretical basis of a computer code ROTORDYNE which in conjunction with an initial finite element analysis and eigenvalue extraction performs a dynamic analysis of a wind turbine rotor for lifetime prediction. The stationary deterministic loads arising from a spatially nonuniform wind field and gravity as well as loads caused by the rotation are described. The turbulence is introduced in terms of power spectra as seen from a point in a rotating frame of reference. Statistics of the combined deterministic period and stochastic response are presented, and an asymptotic theory is derived for the extremes of the responses during production operation of the wind turbines. A fatigue model is presented for the special structure of the stress response. The strategy for applying the models for evaluation of the total lifetime of the rotor is discussed, and an example calculation and a comparison with some measured data from the Nibe-B wind turbine is given. A proposal for further developments of theory and code is outlined. At the present stage of the development the program is restricted to horizontal axis propeller wind turbines with induction generator connected to the main electrical grid, active yaw and a relatively stiff tower. Load cases where the wind turbine stands still in a high wind speed as well as start and stop are not yet considered. In the case of no basic assumption being violated the computer program calculates responses of wind turbine rotors, their extremes and the associated damage with satisfactory accuracy for wind turbines in operation.

44151 **(SL—83148.40) Power measurements on 15 kW REYMO wind turbine sited at Skodborg, South Jutland.** Paulsen, U.S.; Bjerregaard, E.T.D. (Skibsteknisk Laboratorium, Lyngby (Denmark)). Jul 1984. 26p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752487.

This report contains results of measurements carried out on a 3-bladed, 15 kW HAWT wind turbine, which is operating in parallel with the electrical grid. The REYMO wind turbine is equipped with a "pipecage" generator. The HAWT was tested in the period February to July 1984. The wind turbine is sited at Skodborg, South Jutland. The measurements are accomplished with the mobile field test station developed at the Danish Maritime Institute. The test programme performed has given information on - the electrical power output from the wind turbine as a function of the wind speed at hub-height; - the total efficiency of the wind turbine as a function of the wind speed at hub-height; - the annual energy production of the wind turbine in operation under different wind conditions. Fully availability is assumed. The power curve of the

HAWT follows a S-shaped curve. A stall region with the limited power level is not found at wind speeds up to 19 m/s. The measurements have been carried out for: The Test Station for Minor Windmills, Risoe National Laboratory. The measurement techniques are following the IEA recommendations: Power performance testing, Ref. 1. The presentation of measuring equipment, analysis techniques and time histories for the test period is given in Ref. 3.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 45282

44152 (CONF-8506121—2) Horizontal electric fields from lightning return strokes. Thomson, E.M.; Uman, M.A.; Johnson, J.; Stone, J.W.; Medelius, P.; Rubenstein, M. (Florida Univ., Gainesville (USA). Dept. of Electrical Engineering). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016367.

From International conference on lightning and static electricity; Paris, France (10 Jun 1985).

Measurements are presented of simultaneous horizontal and vertical electric fields from both close and distant lightning return strokes. The data were obtained during summer 1984 at the Kennedy Space Center, Florida, using an electrically isolated spherical antenna having a system bandwidth of 3 Hz to 5 MHz. Lightning signals were obtained from flashes at distances from a few to 100 kilometers. Since the horizontal electric field is in part determined by the local ground conductivity, that parameter was measured as a function of depth. The horizontal fields from lightning return strokes had typically 1/50 the peak amplitude of the vertical fields and waveshapes which were consistant with available theory, as expressed by the "wavetilt" formula.

44153 (DOE/ET/29032—1) Dynamic stability of electric power systems. (Systems Control, Inc., Palo Alto, CA (USA)). Aug 1985. Contract AC01-78ET29032. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85016102.

Multi-input and multi-output frequency domain methods are developed and implemented for the study of power system dynamic stability and robustness of stability due to system parameter perturbations. The linearized dynamic model for an interconnected power system is cast into the form of a multivariable feedback system. A number of different multiple-input, multiple-output (MIMO) feedback configurations can be realized. Each of these model the linearized dynamics of the interconnected power system and retain the sparsity of the system. The stability of the feedback system is determined through the application of the Nyquist encirclement criterion to the determinant of the return-difference matrix. Examples for a study system are presented which further illustrate the method. The practical aspects of the proposed approach for application to realistically-sized power systems are discussed. For the study of robustness of dynamic stability, perturbations in the operating point resulting from variations in power supply and demand quantities and eventually leading to the perturbations of the linearized feedback system are of primary interest. Three approaches are considered: (1) an approach based on matrix-norm robustness criteria, (2) an optimization-based approach using the return-difference matrix, and (3) an approach using stability and robustness results for the component connection model. The first and second approaches are illustrated using examples of single machine and an infinite-bus system.

44154 (EPRI-EL—3990) Unified active and reactive power modulation of HVDC systems: evaluation of controller design and robustness. Grund, C.E. (General Electric Co., Schenectady, NY (USA). Electric Utility Systems Engineering Dept.). May 1985. 89p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920828.

Advanced HVDC modulation techniques have been developed and evaluated for the stabilization of ac/dc networks. These techniques were initially developed under EPRI RP1426-1 as reported in report EPRI EL-2101. In this phase (1426-2), the software algorithm for the control system has been developed for digital hardware implementation. The dynamic performance of the control algorithm was evaluated at various nominal and off-nominal conditions. These digital test results illustrate the effectiveness of the control system based on small-scale power system models. The modulation controller utilizes rectifier commutation bus frequency input and produces dc power and voltage modulation signals. The controller is assumed to be located at the rectifier terminal and the dc voltage modulation signal is transmitted to the inverter terminal with a maximum communications delay of 50 milliseconds.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 43693, 43694, 43702, 43703, 43948, 44168, 44468, 44501, 44893

44155 (CEA-CONF—7216) Use of sulfur as working fluid for topping cycles. Goldstein, S.; Vrillon, B.; Le Sech, A.; Foucault, M.; Roussel, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1984. 11p. (CONF-840204—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750563.

From International seminar on energy conservation in industry; Duesseldorf, F.R. Germany (13 Feb 1984).

The use of sulfur as working fluid for topping cycles can improve significantly the efficiency of a power station. The topics developed in the paper are: 1) corrosion: results of tests on samples and small components; 2) thermodynamics: review of physical properties and estimation of the internal irreversibilities; heat transfer calculations and measurements; 3) the ESTHER loop: description and status of construction; 4) description of a prospective industrial project.

44156 (DGRST—81-D-1238) Optimization of a supersonic turbine set through an ammoniac cycle. Tillequin, M. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1982. 59p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751279.

The state of the art of the ammonia downstream cycle for the production of electricity is first presented. A presentation of the research program is then given. Then one deals with the study and the construction of the test loop. Causes of non-determination of the specific vaporization coefficients and of condensation of ammonia sought are explained. Finally one shows the need to respecify the research program.

44157 (DOE/MC/20241—T12) Gas turbine systems for operation on coal-derived fuels. Final technical report. Giramonti, A.J. (United Technologies Research Center, East Hartford, CT (USA)). Jul 1985. Contract AC21-83MC20241. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015604.

The objectives of this program were to define the most attractive gas turbine power systems that could operate on coal-derived fuel and to identify a research and development program that could lead to commercialization. The power systems investigated included a combined cycle system for baseload electric utility applications, a simple cycle gas turbine for utility peaking applications, and a gas turbine cogeneration system for industrial process applications. The coal-derived fuels included a partially-cleaned fuel gas and a coal-water mixture. Both fuel systems were investigated for the baseload electric utility application, whereas only the coal-water mixture was investigated for the utility peaking and industrial cogeneration applications. The focal activity of the program was a comprehensive systems analysis which addressed critical technical, economic, environmental, and reliability issues. This analytical effort followed closely the spirit of systems analysis in that it drew on existing information to the maximum extent possible in order to minimize duplication of past efforts. The program was conducted in two consecutive phases, dealing primarily with large electric utility size systems and smaller industrial cogeneration systems, respectively. The principal purpose of this investigation was to identify the most promising way in which gas turbine power systems could operate on coal-derived fuels to produce low cost electricity while complying with applicable environmental regulations. A secondary purpose was to identify technology gaps which would need to be

resolved before commercialization could be implemented. The highlights from the utility systems analysis phase of this study are summarized. 6 refs., 19 figs., 8 tabs.

44158 **(DOE/RA/50421—1) Studies in nonlinear large scale systems theory.** (Scientific Systems, Inc., Cambridge, MA (USA)). Aug 1985. Contract AC01-80RA50421. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016535.

Whether decentralized control is feasible and desirable for a large scale system depends to a large extent on its dynamic structure. The objectives of this contract have been (1) to develop new theoretical techniques to analyze and simplify scale systems, and (2) to investigate the applicability of these techniques to models used by electric utility analysts and planners.

44159 **(EPRI-AP—4039) Reliability, availability, and maintainability audit of the Cool Water Plant Units 3 and 4, Southern California Edison Company. Final report.** Young, R. (Arinc Research Corp., Annapolis, MD (USA)). May 1985. 66p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920818.

An audit of two combined-cycle units at Southern California Edison's Cool Water Plant showed that the combustion subsystem caused the largest number of outages. The data analysis not only provided valuable insights into the plant's reliability, availability, and maintainability but also described audit methods that will be useful to utilities.

44160 **(EPRI-AP—4194) Evaluation of protective coatings for hot components of combustion turbines. Final report.** McMinn, A. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1985. 143p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920855.

The objective of this program was to evaluate the hot corrosion resistance of several protective coatings that had been applied to MAR-M-509 nozzle guide vanes and exposed in a utility gas turbine. The coatings evaluated included basic aluminide, rhodium-aluminide, platinum-rhodium-aluminide and palladium-aluminide diffusion coatings, and CoCrAlY and ceramic overlay coatings. A combination of metallographic examination of vane cross-sections, remnant coating thickness measurements, and energy dispersive X-ray analysis were employed in the evaluation. The results indicated that none of the coatings were totally resistant to corrosive attack, but that the CoCrAlY and platinum-rhodium-aluminide exhibited the greatest resistance to hot corrosion. The CoCrAlY coated vanes were particularly susceptible to thermal fatigue cracking. Except for the poor performance of the palladium-aluminide coating, the precious metal aluminides offered the best protection against corrosion. Hot isostatically pressing coatings was not found to be beneficial, and in one case appeared detrimental. 34 refs., 7 tabs., 60 figs.

44161 **(EPRI-CS—3623) Seminar on dissimilar welds in fossil-fired boilers: proceedings.** Viswanathan, R.; Roberts, D.A. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA); GA Technologies, Inc., San Diego, CA (USA)). Jul 1985. 431p. (CONF-8402154—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920768.

From Seminar on dissimilar welds in fossil-fired boilers; New Orleans, LA, USA (23 Feb 1984).

Failure of dissimilar metal welds (DMW) in superheater and reheater sections is a major cause of forced outage of boilers. Research and development has been in progress at several organizations throughout the world including a major project, RP 1874, sponsored by EPRI. As a result of these efforts the causes of DMW failures are now better known than before. Several viable remedies have been identified. The effects of plant operational variables on damage to the DMWs have been quantified. Methods for assessing the condition of DMWs in the field have been developed. A seminar was organized for the purpose of reviewing and consolidating all the information available relating to failure causes and remedies for the DMW failure problems. The proceedings from the seminar are presented in this report. The papers have been entered individually into EDB and ERA. (LTN)

44162 **(EPRI-CS—4001) Steam turbine blade reliability seminar and workshop: proceedings.** Brown, R.G.; Quilliam, J.F. (eds.). (Delian Corp., San Jose, CA (USA)). Jul 1985. 549p. (CONF-8207120—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920224.

From Steam turbine blade reliability seminar and workshop; Boston, MA, USA (7 Jul 1982).

An EPRI workshop to address steam turbine blade reliability improvement was cohosted by Boston Edison Company in Boston, Massachusetts on July 7-9, 1982. The 142 attendees represented a broad spectrum of US utilities, equipment manufacturers, and consultants, as well as representatives from Canada, Europe, and Japan. These proceedings contain the text of the formal presentations as well as summaries of the working group sessions which were devoted to topics of particular interest to the workshop participants. The formal presentations were organized under the following general session titles: utility experience with turbine blades; blade failure mechanisms and causes; blade design for high reliability; problem solutions for operating units; and failure analysis, NDE, and diagnostics. In addition to the technical presentations, working group sessions were held on selected topics relevant to steam turbine blade reliability improvement. Each group provided a forum for engineers to exchange ideas and information in a less formal environment. These discussions focused on key issues in more detail and addressed some subjects not covered in the formal presentations. The subjects of these working groups were: low pressure turbine blade problems; solid particle erosion; steam chemistry; failure analysis, NDE, and diagnostics; effect of boiler and balance-of-plant; and retrofittable fixes for blade problems. Individual papers have been entered into EDB and ERA. (LTN)

44163 **(EPRI-CS—4155) Feedwater heater procurement guidelines. Final report.** Holtz, M.J.; Singh, K.P.; Walsh, M.J.; Menuchin, Y.; Chhina, M.; McAnany, F. (Oat (Joseph) Corp., Camden, NJ (USA)). Jul 1985. 363p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920792.

Reliability of closed feedwater heaters has become a subject of increasing interest to the electric power generation industry. A comprehensive design specification is an essential prerequisite to procuring a high quality heater. This report provides a generic document from which "custom" purchasing specifications for specific heaters can be developed. The logic and rationale of many provisions of the specification are explained in the "sourcebook" part of this report. The sourcebook is also intended to serve as a convenient reference material for many important design and fabrication topics in the field of heater technology. 34 refs., 114 figs., 22 tabs.

44164 **(EPRI-CS—4204) Suction effects on feedpump performance: a literature survey.** de Vries, M.; Simon, A. (Sulzer Bros. Ltd., Winterthur (Switzerland)). Aug 1985. 131p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920835.

The influence of suction effects on the performance of main boiler feed and booster pumps has been analysed. This report provides a critical literature survey of this topic and is the first step on the way to recommendations for pump and plant (architect) engineers. The problems surveyed can roughly be reduced to two main emphases: Effects on boiler feed pumps and their suction system during standby after shut-off, and the various protection systems. Effects of deaerator transients on suction pressure of boiler feed pumps due to a fast reduction of turbine load or a turbine trip, and the various protection systems. Going beyond a pure literature survey, step-by-step methods have been outlined to calculate the optimum suction pipe diameter as well as the influence of various suction systems and plant parameters on pump performance. Although further work remains to be done, many analytical approaches in this report can be used now as a guide when planning a power station. 40 refs., 51 figs.

44165 (EPRI-EM—4200) Design and cost of standardized lead-acid battery systems for utility energy management. Final report. Eckroad, S.W. (Bechtel Group, Inc., San Francisco, CA (USA)). Aug 1985. 89p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920798.

The present report describes an investigation of cost reduction opportunities through standardization. For a standard plant size reflecting a compromise between plant costs and limited market size (2 MW/1.6 MWh), a number of space and cost saving plant configurations were evaluated. A modular, tiered battery approach provided the lowest cost and highest-energy-per-plant-area (kWh/ft^2) design. Larger plants, built up using the standard plant module, were postulated to obtain peak power capabilities up to 6 MW and/or discharge durations (at full power) up to 4.3 hours. Costs for the standard plant approach were developed under a scenario in which 10 plants per year are being produced. Balance-of-plant (BOP) costs were reduced by more than 40% and overall plant costs by about 25% over the custom, one-of-a-kind design postulated in previous phases of this work. The potential economic benefit of both utility customers and utilities will be increased proportionately if a standardized plant approach is adopted.

44166 (RISO-R—508) SIMULACHRON. A simulation mode for a combined heat and power production system. Larsen, H.V. (Risoe National Lab., Roskilde (Denmark)). Feb 1984. 154p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85752492.

This report gives a short survey of problems concerning the evaluation of development plans for a combined heat and power system. A rather detailed model describing technical and economic aspects of the system is set up. This comprises condensing, extraction, and back-pressure power plants, district heating boilers, and day-to-day heat storage facilities. Transmission systems for heat and power are also modelled. The model has been implemented on a computer. By means of the computer program, called Simulachron, the operation of a combined heat and power system can be simulated on an hour-to-hour basis. Test-runs of the program covering 48 time steps and some 30 power plants are documented.

44167 (CE-Trans—8046) Chemical cleaning of a brass-tubed turbine condenser after five years of operation with ferrous sulphate dosing. Gutberlet, H. Translated from *VGB Kraftwerkstechnik ;* **63**: No. 2, 183-190(Feb 1983). 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901980.

The purpose of chemically cleaning the brass-tubed turbine condenser was to remove the ferrous oxide layer and corrosion products which are mainly copper oxide Cu_2O. Laboratory tests were conducted where 1 m long pieces of tube were installed in a small acid circuit which was designed to simulate the condenser circuit. The solubility of the oxide coating was tested in hydrochloric, sulfuric, formic and citric acids at different concentrations. The oxide coating was soluble in all cases, but the tube pieces treated with citric acid looked best. Citric acid was chosen because of its low corrosive effect on brass, its low cost and because it was also the only one permitting on-site handling which was more or less safe. In addition, citric acid also proved to be particularly suitable for dissolving a ferrous oxide layer from the chemical point of view, since it forms stable metal chelates with iron (III) ions. The pH value remains nearly constant even with complete conversion of the citric acid into iron citrate. Starting from the pure citric acid, the dissolution of the iron oxide begins at pH 2.3 and, with quantitative conversion of the citric acid into the complex, ends at pH 3.0. The optimum concentration of citric acid was determined to be a maximum of 1% and lab tests showed three cleaning cycles would be required. The technical implementation of the chemical cleaning process is also described. (AT)

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REFER ALSO TO CITATION(S) 43656, 43658, 43664, 43665, 43672, 44925, 45091, 45099, 45101, 45102, 45137

44168 (BMFT-FB-T—85-065) Design of bituminous-coal-fired power plant consisting of environment-protecting components. Haji-Javad, M.; Heinisch, M.; Hetschel, M.; Hutter, F.; Ludwig, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)). Jul 1985. 313p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE85752693.

The study surveys environment-protecting technologies which it is possible to apply at the present time in power stations firing bituminous coal in the public electricity supply sector. Its coverage extends beyond the publications already known and the results of the BMFT programme 'Environment-protecting bituminous-coal-fired power station' by taking into consideration the way the various components of a power station influence one another. The components investigated are plants for NOsub(x), removal, dust removal, desulphurization, ash removal, input and efficient water treatment, and coal handling. The unit capacities concerned are 175, 350 and 700 MW. The study relates exclusively to the new design of power station units for operation in the lower medium-load range. Retrofitting questions are not dealt with. The aim of the approach adopted was to represent various power station configurations in model form so as to indicate the connection between reduction of the environmental input and the outlay necessary for this purpose. This revealed an optimum design and arrangement of flue gas cleaning plants and efficient water treatment plants. The result is reflected in the design of power station units achieving concentration values which can be classed as environmentally accepted.

44169 (DES—74-92) Draft supplement to the environmental statement, fiscal year 1976 proposed program. Facilty location evaluation for Franklin-Badger Canyon 230-kV line and Badger Canyon Substation study area 74-6B. (Bonneville Power Administration, Portland, OR (USA)). 22 Oct 1974. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016099.

Proposed is the construction of a 15-mile, 230-kV double-circuit transmission line from Franklin Substation near Pasco, Washington, to a proposed new Badger Canyon Substation to be constructed 5 miles west of Kennewick, Washington. Depending on the final route location chosen, approximately 15 miles of 230-kV double circuit transmission line requiring 5.6 miles of new and 9.4 miles of existing right-of-way would be needed as well as approximately 2500 feet of new access road. Land use affected includes crossing Sacajawea State Park and passig through irrigated cropland and grassland on existing right-of-way, and depending on the alternative route chosen, could cross land proposed for residential development and a proposed interstate highway. An additional 10 to 11 acres of potential cropland would be required for the proposed substation. Disturbance to wildlife during construction would occur and habitat associated with the above land uses would be eliminated. Some erosion and sedimentation would occur. Visual impacts would affect Sacajawea State Park, a proposed highway, and potential residential development land. Noise and other disturbances to residents will occur, primarily during construction.

44170 (DES—74-95) Draft supplement to the environmental statement, fiscal year 1976 proposed program. Facility location evaluation for Horse Heaven Hills Area Service (Horse Heaven Substation) study area 75-7. (Bonneville Power Administration, Portland, OR (USA)). 22 Oct 1974. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016103.

The proposed plan of service consists of the construction of a new substation near Patterson, Washington. Land requirements for the new substation would be approximately 20 to 22 acres of land depending on the final site location chosen. Access road requirements range from 100 feet for alternative site 4 to 2000 feet for alternative site 2. The proposed facility would remove the land

from potential irrigation development and could interfere with irrigation practices on adjacent land. Disturbance to wildlife and elimination of habitat associated with the above land requirements would occur. Soil erosion would result from site and access road grading. This facility would be visible from Washington Highway 14.

44171 **(DES—75-23) Draft supplement to the environmental statement, fiscal year 1976 proposed program. Facility location evaluation for Okanogan Area Service study area 75-6.** (Bonneville Power Administration, Portland, OR (USA)). 15 Apr 1975. 96p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016104.

Proposed is the construction of a substation west of Okanogan, Washington, a 115-kV line between Okanogan and Tonasket, and a 230-kV line between Bridgeport and Okanogan. Depending on the final route location chosen, between approximately 56 and 63 miles of transmission line from Okanogan to Tonasket and from Bridgeport to Okanogan, most of which would require new right-of-way, would be required. Between 16 and 45 miles of new access road would be required. Land use affected would include temporary impact to between 28 and 50 acres of rangeland and between 3 and 8 acres of forest land. A minimal amount of agricultural land would be impacted as a result of several of the alternative locations. In addition, approximately 4 acres of rangeland would be permanently removed due to construction of the proposed new substation. Other impacts would include the removal of wildlife associated with the above mentioned right-of-way requirements. Disturbance to wildlife during construction would occur. Some erosion and sedimentation would occur. Visual impacts would result from clearing rights-of-way through forested areas. Noise and other disturbances to residents will occur, primarily during construction.

44172 **(DES—75-63) Draft supplement to the environmental statement, fiscal year 1977 proposed program. Facility location evaluation for West Burley Service Study Area 75-9.** (Bonneville Power Administration, Portland, OR (USA)). 15 Dec 1975. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016107.

Proposed is the construction of approximately 7 miles of 138-kV transmission line between the newly planned West Burley Substation (to be constructed by the customers) and BPA's Unity Substation, both near Burley, Idaho. In addition, new terminal facilities will be added to the Unity Substation. Depending upon the final route location chosen, between 7 and 8 miles of 138-kV line between West Burley Substation and Unity Substation would be required. Little or no new access road would be required under each of the alternatives. Other impacts would include slight disturbances to natural vegetation, cropland, and associated wildlife habitat. Disturbance of wildlife would be primarily restricted to the period during and immediately after construction. Visual impacts would also occur. Noise and other disturbances to residents will occur, primarily during construction.

44173 **(DOE/EIS—0005-DS-2) Draft supplement, Final Environmental Impact Statement, proposed fical year 1979 program. Facility planning supplement: southwest Oregon area service.** (USDOE Bonneville Power Administration, Portland, OR). Jan 1979. 111p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85016108.

To allow power generated in Wyoming to be delivered to Southwest Oregon and to facilitate the exchange of electric power between the Pacific Northwest and the Middle Snake region, two basic plans of service, each with two corridor routing options, have been identified to meet system requirements. BPA proposes construction of the following two transmission facilities: a 500-kV line from Idaho Power Company's Brownlee Substation in Idaho to BPA's Slatt Substation near Arlington, Oregon, and a 500-kV line from Buckley (near Maupin, Oregon) to Malin, Oregon. The proposed plans of service are the Brownlee-Slatt Corridor 1, a 208-mile (333 km) 500-kV line from Brownlee to Slatt and 500-kV terminals at Slatt, and the Buckley-Malin corridor, a 232-mile (372 km) 500-kV transmission line. The impacts at this planning stage are generalized pertaining to normal construction and maintenance effects. More explicit impacts will be detailed when line locations have been decided upon and BPA studies their related impacts. Construction, operation, and maintenance of a transmission line along any of the alternate corridors would have minimal impact on air quality. Impacts to geology, soils, and vegetation, disturbance to wildlife and recreation facilities would occur during construction activities. All options, except the proposed plan of service, required some new right-of-way. Where new right-of-way is required, impacts would be greater.

44174 **(PB—85-197358/XAB) Aerial photography and ground verification at power plant sites: Wisconsin power plant impact study.** Wynn, S.L.; Kiefer, R.W. (Wisconsin Univ., Madison (USA). Dept. of Civil and Environmental Engineering). Apr 1985. 293p. NTIS, PC A13/MF A01.

Prepared in cooperation with Wisconsin Dept. of Natural Resources, Madison, Wisconsin Public Service Commission, Madison, and Wisconsin Public Service Corp., Green Bay.

This study demonstrated and evaluated nine methods for monitoring the deterioration of a large wetland on the site of a newly-constructed coal-fired power plant in Columbia, County, Wisconsin. Four of the nine methods used data from ground sampling; two were remote sensing methods without ground verification; and three were remote sensing methods which either used ground verification or relied on the analyst's on-the-ground knowledge of the area. These methods were evaluated on the basis of whether they monitor change at a species or a community level, whether they monitor community change in terms of area or location or both, and whether they provide information about trends in plant communities.

44175 **(PB—85-200244/XAB) Trends in sulfur dioxide emissions from the electric-utility industry and ambient sulfur dioxide concentrations in the northeastern United States, 1975-1982.** Pollack, A.K.; Burton, C.S. (Systems Applications, Inc., San Rafael, CA (USA)). May 1985. 153p. NTIS, PC A08/MF A01.

Trends in monthly power plant SO_2 emissions and monthly average ambient SO_2 concentrations are determined for 21 northeastern states and the District of Columbia. Due to the recession of the late 1970's, power plant emissions in most of the industrialized states decreased by up to 30%. Meanwhile, for more than half of the states, there is evidence of a downward trend in the ambient concentrations, even though many of the monitoring sites were located in urban areas. Correlations of the seasonally adjusted emissions and ambient concentrations were calculated at the local, state, and regional levels. In general, higher correlations are observed in those states with higher levels of emissions. In the six-state region of the Ohio River Valley, the correlation between the seasonally adjusted emissions and ambient concentrations was 0.75.

44176 **(PB—85-203107/XAB) Fluid-modeling demonstration of good-engineering-practice stack height in complex terrain.** Snyder, W.H.; Lawson, R.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Apr 1985. 101p. (EPA—600/3-85/022). NTIS, PC A06/MF A01.

A demonstration study using fluid modeling to determine the good-engineering-practice (GEP) stack height for a power-plant installation in complex terrain is discussed. The site chosen for this demonstration study was the Clinch River Power Plant in southwestern Virginia, and a 1:1920 scale model of surrounding terrain was constructed. Measurements are presented that describe the simulated atmospheric boundary-layer structure, plume-dispersion characteristics in that boundary layer, and the maximum ground-level concentration (glc) of effluent downstream from the source, both in the presence of all significant terrain surrounding the plant and in the absence of nearby upwind terrain. Analysis of the maximum glc showed that, in this case, a stack height of 326 m meets the current GEP criteria under 50% plant-load conditions, i.e., the nearby upwind terrain effected an increase of 40% in the maximum ground-level concentration.

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REFER ALSO TO CITATION(S) 44706

44177 (EPRI-EL—3996) Evaluation of ultrahigh-speed relay algorithms. Final report. Cabeza-Resendez, L.Z.; Greenwood, A.N.; Lauber, T.S. (Rensselaer Polytechnic Inst., Troy, NY (USA)). May 1985. 348p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920826.

By reducing the time between transient sensing and breaker tripping, ultrahigh-speed relays could make increased loading of transmission lines possible. Development of those relays requires algorithms that respond correctly to system transients. This analysis shows that a broader base of data than is now available is needed for validation of developed algorithms.

44178 (EPRI-EL—4042) Corrosion of the concentric neutrals of buried URD cables. Final report. Hennessey, M.G.; Prime, J.B. Jr.; Compton, K.G.; Valdes, J.G.; Burns, J.G. (Florida Power and Light Co., Miami (USA)). May 1985. 161p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920822.

The corrosion of the wire concentric neutrals on buried URD cable has been studied in a test plot in South Florida. The backfill was a combination of sand and muck to give a resistivity of about 2500 ohm. cm. Various wires were used for the neutrals, some wires and cables received impressed ac current, other received no impressed current, thus making a good spectrum of actual practice. It was found that ac shifted the potential to earth of the neutrals, both negatively and positively, depending upon the ac current density, thus creating long corrosion cells. A threshold of ac current density was found, above which corrosion was greatly accelerated, at 1.5 mA/cm^2 in the soil used in this test. This confirms similar thresholds found by others (37 and 38). Simple cable to earth potential measurements did not reveal the presence of corrosion. A historical review of the subject of ac corrosion and its mechanism is given. AC is shown as a clearly significant factor in the corrosion of concentric neutrals of buried URD cable in the soils of the FPL Test Plot.

44179 (EPRI-EL—4188) Study of a component evaluation unit for remote maintenance of transmission lines. Henkener, J.A. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1985. 47p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920802.

Successful field tests of an experimental device for remote maintenance of transmission lines provided design information for a prototype unit to be tested by utilities in regular maintenance work. The device will facilitate line repair during inclement weather.

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REFER ALSO TO CITATION(S) 43889

44180 (EPRI-NP—4141) Functional specifications for AI software tools for electric power applications. Final report. Faught, W.S. (Intellicorp, Menlo Park, CA (USA)). Aug 1985. 251p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920800.

The principle barrier to the introduction of artificial intelligence (AI) technology to the electric power industry has not been a lack of interest or appropriate problems, for the industry abounds in both. Like most others, however, the electric power industry lacks the personnel - knowledge engineers - with the special combination of training and skills AI programming demands. Conversely, very few AI specialists are conversant with electric power industry problems and applications. The recent availability of sophisticated AI programming environments is doing much to alleviate this shortage. These products provide a set of powerful and usable software tools that enable even non-AI scientists to rapidly develop AI applications. The purpose of this project was to develop functional specifications for programming tools that, when integrated with existing general-purpose knowledge engineering tools, would expedite the production of AI applications for the electric power industry. Twelve potential applications, representative of major problem domains within the nuclear power industry, were analyzed in order to identify those tools that would be of greatest value in application development. Eight tools were specified, including facilities for power plant modeling, data base inquiry, simulation and machine-machine interface.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 43858, 44277, 44280, 44312, 44313, 44319, 44340, 44342, 44346, 44350, 44351, 44352, 44353, 44356, 44368, 44373, 44374, 44375, 44388, 44389, 44394, 44398, 44406, 44412, 44428, 44429, 44435

44181 (AECL—8179) Steam generator tube performance. Experience with water-cooled nuclear power reactors during 1981. Tatone, O.S.; Pathania, R.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1983. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701997.

A review of the performance of steam generator tubes in 110 water-cooled nuclear power reactors showed that tubes were plugged at 46 (42 percent) of the reactors. The number of tubes removed from service increased from 1900 (0.14 percent) in 1980 to 4692 (0.30 percent) in 1981. The leading causes of tube failures were stress corrosion cracking from the primary side, stress corrosion cracking (or intergranular attack) from the secondary side and pitting corrosion. The lowest incidence of corrosion-induced defects from the secondary side occurred in reactors that used all-volatile treatment since start-up. At one reactor a large number of degraded tubes were repaired by sleeving which is expected to become an important method of tube repair in the future.

44182 (CONF-850507—51) Neutron total cross section of ^{240}Pu below 6 eV and the parameters of the 1.0-eV resonance. Spencer, R.R.; Harvey, J.A.; Hill, N.W.; Weston, L.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016158.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Measurements of the low-energy neutron transmission of five different ^{240}Pu samples have been made using the Oak Ridge Electron Linear Accelerator (ORELA) pulsed-neutron source and the time-of-flight technique in an attempt to resolve discrepancies between the evaluated low-energy cross section of this nuclide and the observed production of heavier Pu isotopes in light-water reactors (LWRs). Three "thin" samples consisting of Pu metal foils containing 0.73 at. % ^{240}Pu were measured above 0.4 eV in order to derive the parameters of the 1.056-eV resonance, which is responsible for most of the observed 2200-m/s cross section. Two "thick" samples of 99.97 at. % ^{240}Pu metal were measured from 0.003 eV to about 6 eV to obtain the 2200-m/s cross section and the cross-section shape in the low-energy region. A consistent set of resonance parameters was derived from the above data sets.

44183 (CONF-850601—1) Fracture behavior and microstructural characteristics of irradiated Zircaloy cladding. Chung, H.M.; Yaggee, F.L.; Kassner, T.F. (Argonne National Lab., IL (USA)). Jun 1985. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF AO1 - GPO. File Number TI85014994.

From 7. international conference on zirconium in the nuclear industry; Stasbourg, France (24 Jun 1985).

Zircaloy cladding tube specimens from commercial power reactor fuel assemblies (burnup >22 MWd/kgU) have been deformed to fracture at 325°C by either the internal gas-pressurization or the expanding-mandrel technique in a helium or argon environment containing no fission product species (e.g., I, Cs, or Cd). The fracture surfaces of 11 irradiated specimens fractured by internal gas pressurization were examined by scanning electron microscopy, and 7 specimens were found to contain various degrees of the pseudocleavage feature that is characteristic of pellet-cladding interaction failures. Out of 10 test specimens fractured by expanding-mandrel loading, 5 were found to contain regions of pseudocleavage on

the fracture surfaces. The specimens exhibited "X-marks" on the outer surface and brittle incipient cracks distributed on the inner surface, which are also characteristic of pellet-cladding interaction failures.

44184 **(CONF-850902—3) Phenomenological model for stress corrosion cracking of Types 316NG and 316 stainless steel.** Maiya, P.S. (Argonne National Lab., IL (USA)). May 1985. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01 - GPO. File Number TI85014974.

From 2. international symposium on environmental degradation of materials in nuclear power systems--water reactors; Monterey, CA, USA (9 Sep 1985).

A phenomenological model for both intergranular and transgranular stress corrosion cracking (SCC) in constant extension rate (CERT) tests is discussed. The model is based on an estimate of crack-tip strain rate obtained by use of a J-integral approach, a slip dissolution model for SCC, and a J-integral fracture criterion. The model is used to derive correlations between the SCC parameters (such as time to failure and average crack growth rate) and applied (nominal) strain rate. The model is extended to determine similar relationships between the SCC parameters and average near-crack-tip strain rate. The model predictions are compared with CERT test results obtained for Type 316NG stainless steel (SS) in water containing dissolved oxygen and impurities at 289°C over a range of strain rates between 10^{-5} and 10^{-7}/s. Good agreement is obtained between the theoretical description and experimental results. The SCC behavior of Type 316NG SS is also compared with that of Type 316 SS to determine the relative SCC susceptibility of the two materials.

44185 **(CONF-851041—1) Postirradiation analysis of experimental uranium-silicide dispersion fuel plates.** Hofman, G.L.; Neimark, L.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85007935.

From International meeting on research and test reactor core conversions from HEU to LEU fuels; Argonne, IL, USA (15 Oct 1985).

Low-enriched uranium silicide dispersion fuel plates were irradiated to maximum burnups of 96% of ^{235}U. Fuel plates containing 33 v/o U_3Si and U_3Si_2 behaved very well up to this burnup. Plates containing 33 v/o U_3Si-Al pillowed between 90 and 96% burnup of the fissile atoms. More highly loaded U_3Si-Al plates, up to 50 v/o were found to pillow at lower burnups. Plates containing 40 v/o U_3Si showed an increase swelling rate around 85% burnup. 5 refs., 10 figs.

44186 **(CONF-8410142—84) Fracture properties of a neutron-irradiated stainless steel submerged arc weld cladding overlay.** Corwin, W.R.; Berggren, R.G.; Nanstad, R.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number TI85016146.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The ability of stainless steel cladding to increase the resistance of an operating nuclear reactor pressure vessel to extension of surface flaws depends greatly on the properties of the irradiated cladding. Therefore, weld overlay cladding irradiated at temperatures and fluences relevant to power reactor operation was examined. The cladding was applied to a pressure vessel steel plate by the submerged arc, single-wire, oscillating-electrode method. Three layers of cladding provided a thickness adequate for fabrication of test specimens. The first layer was type 309, and the upper two layers were type 308 stainless steel. The type 309 was diluted considerably by excessive melting of the base plate. Specimens were taken from near the base plate-cladding interface and also from the upper layers. Charpy V-notch and tensile specimens were irradiated at 288°C to a fluence of 2×10^{23} neutrons/m^2 (>1 MeV). 10 refs., 16 figs., 4 tabs.

44187 **(DOE/ET/34006—16) Extended Burnup Demonstration Reactor Fuels Program. Annual progress report, April 1983-March 1984.** Exarhos, C.A. (Consumers Power Co., Jackson, MI (USA); Exxon Nuclear Co., Inc., Richland, WA (USA); GPU Nuclear Corp., Parsippany, NJ (USA)). 20 Jun 1985. Contract AC02-79ET34006. 37p. (XN-NF—84-77). NTIS, PC A03/MF A01; GPO Dep. File Number DE85014300.

The US Department of Energy, Consumers Power Company, Exxon Nuclear Company, and General Public Utilities Nuclear Corporation have participated since 1979 in a cooperative Extended Burnup Demonstration Program. Under the program, standard ENC-fabricated reload fuel in the Big Rock Point and Oyster Creek reactor cores has been irradiated to discharge burnups at or beyond 35,000 MWD/MTU, one to two cycles beyond its originally projected exposure life. The program provides for examination of the fuel at poolside before and after each extended burnup cycle as well as for limited destructive hot cell examination. The 1984 progress report covers work performed under the EBD program between April 1983 and March 1984. Major milestones reached during the period include completion of a hot cell examination on four high burnup rods from Big Rock Point and of a poolside on the Oyster Creek EBD fuel at discharge. The hot cell examination of four rods at burnups to 37.2 GWD/MTU confirmed poolside measurements on the same fuel, showing the urania and gadolinia-bearing fuel rods to be in excellent condition. No major cladding degradation, pellet restructuring, or pellet-clad interaction was found in any of the samples examined. The Oyster Creek fuel, examined at an assembly average exposure of 34.5 GWD/MTU, showed good performance with regard to both diametral creep-down and clad oxide accumulation.

44188 (DOE/NE/34130—1-Vol.1, pp 2.81-2.94) **Improved fuel management strategies for TVA's nuclear reactors.** Brown, P.D.; Juergens, C.C.; Rahn, R.R.; Robert, J.T.; Taylor, O.W. (Tennessee Valley Authority, Chattanooga). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

TVA currently has five operating nuclear reactors and four more under construction. A substantial effort has been made in the last 7 years to find improved fuel designs and improved fuel management strategies for these reactors. Originally the operating units started out using 12-month cycles with low expected discharge batch burnups. The first major improvement was the use of 18-month cycles in order to reduce system generation costs, although the nuclear fuel cost was increased. In addition, the Browns Ferry (BWR) units began using, or will use in the future, end-of-cycle coastdown, control cell core, and GE's barrier fuel. The Sequoyah (PWR) units are now using Westinghouse's wet annular burnable absorbers and low leakage loading patterns. TVA has also been actively pursuing the use of higher burnup fuel assemblies for both operating plants. It appears, however, based on recent calculations, that Browns Ferry may be reaching a plateau in fuel cost saving due to higher burnup. Fuel reliability at TVA's Browns Ferry and Sequoyah reactors has been fair on average. Browns Ferry unit 3 and Sequoyah units 1 and 2 fuel has performed well. TVA's continual review and evaluation of new fuel designs and alternative fuel management strategies has resulted in improvements which are currently saving TVA several millions of dollars annually. The full implementation of these improvements will result in additional fuel cost savings while maintaining and hopefully improving our long-term fuel reliability.

44189 (DOE/NE/34130—1-Vol.1, pp 3.1-3.16) **Corrosion and hydriding of Zircaloy fuel rod cladding in 633K water and reactor environments.** Clayton, J.C.; Fischer, R.L. (Westinghouse Electric Corp., West Mifflin, PA). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Water corrosion tests at 633K were performed to determine the corrosion and hydriding characteristics of Zircaloy-4 tubing fabricated by cold reduction and finished in two metallurgical con-

ditions, recrystallization annealed (RXA) and stress-relief annealed (SRA). The corrosion tests revealed differences in the post-transition corrosion product weight gain of the two materials. SRA Zircaloy corroded faster than RXA tubing. A computer program model, designated CHORT, was developed from the test data. The model attributes the observed difference in corrosion rate to a difference in the periodicity of a postulated cyclic transition of the oxide. A first-order correction for the effect of radiation environment was also included in the CHORT model. Zircaloy corrosion performance predicted with the CHORT computer program was compared with measured data from 214 out-of-pile Zircaloy-4 tubing specimens, 45 irradiation test fuel rods, three special irradiation test fuel rods with long lifetime and high fluence (MELBA), and fuel rod cladding from three commercial pressurized water reactors. Measured corrosion oxide thicknesses and hydrogen pickup values were in reasonable agreement with CHORT predictions.

44190 (DOE/NE/34130—1-Vol.1, pp 3.37-3.54) **In-reactor corrosion and crud deposition data on Fragema fuel.** Thomazet, J.; Noe, M.; Lavoine, O. (Fragema, Lyon, France). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Commissariat a l'Energie Atomique (CEA), Electricite de France and Fragema have jointly implemented an extensive program of research into fuel cladding external corrosion. The fuel irradiation conditions planned for the coming years (i.e., simultaneous nucleate boiling operation combined with high burnup levels and load follow) have led to a series of test loop and in-reactor studies. This paper describes the impact of boiling on crud deposition and clad oxidation phenomena, measurements taken from high burnup rods and the first results obtained during load follow operation. Nucleate boiling heat transfer has been shown to affect clad deposition and corrosion. The chemical properties of the primary coolant system should be kept under surveillance. A high burnup experiment (up to 55,000 MWd/mtU) leads to good reliability of the fuel cladding. First results obtained in load follow conditions confirm that an extensive fuel surveillance in these new operational settings is required.

44191 (DOE/NE/34130—1-Vol.1, pp 3.73-3.90) **Nuclear fuel cladding localized corrosion.** Marlowe, M.O.; Armijo, J.S.; Cheng, B.; Adamson, R.B. (General Electric Co., San Jose, CA). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

In 1979, a new, rare and unexpected mechanism of localized fuel cladding corrosion failure in some BWRs was revealed. The failures occurred at exposure levels of 15-20 GWD/MT and were highly concentrated in $(U,Gd)O_2$ rods. Fuel examinations, surveillance, and extensive research have led to a practical understanding of this mechanism. Heavy plant corrosion product (crud) scale deposits with high copper concentrations rather than the typical fluffy iron oxide crud was found. The failed rods had flaking of the oxide and crud scale occurring in two bands along the failed fuel rods and local ~1/8 in. diameter through-wall corrosion pits. The nature of the failures led to identification of special conditions of environment, duty, and material-susceptibility that must occur simultaneously to cause failure. These crud induced localized corrosion (CILC) failures have been limited to plants with copper alloy condenser tubes and filter-demineralizer condensate cleanup systems. Copper rich crud was deposited preferentially between oxide nodules and within the normal laminations of the oxide, promoting delamination and increasing local thermal resistance. As understanding of the CILC mechanism became available, actions were taken to preclude failures including implementation of processes to assure nodular corrosion resistance.

44192 (DOE/NE/34130—1-Vol.1, pp 3.91-3.102) **Relation between autoclave tests and in-reactor corrosion measurement results for Zircaloy.** Vesterlund, G.; Lundblad Vannesjoe, K.; Rudling, P. (ASEA-ATOM AB, Vaesteras, Sweden). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

In BWRs, the corrosion properties of Zircaloy components, specifically fuel cladding, are strongly dependent upon the reactor operating conditions as well as the manufacturing history of the component itself. The currently available standardized corrosion tests, like the present ASTM test, are not capable to predict the in-reactor oxidation rate of the BWR fuel cladding. The current trend to increase the EOL burnup will increase the cladding corrosion; consequently to increase or restore margins, it is important to develop a corrosion out-of-reactor acceptance test. The 500°C high pressure steam corrosion test has in some situations correlated with the in-BWR corrosion performance. Welded Zircaloy material is highly resistant to both in-reactor and out-of-reactor conditions, i.e., high temperature, high pressure, steam conditions. Due to this fact, the ASEA-ATOM fuel channels manufactured today are heat-treated by a temperature cycle designed to simulate the fast heat-up and cool down cycle of the heat-affected zone of a weld. This has greatly improved the fuel channel corrosion resistance, compared to non-heat-treated channels. Significant improvements in BWR in-pile corrosion properties of Zircaloy cladding tubes can be achieved by changing its manufacturing process. Specifically the β-quenching in an intermediate size, in the tubing production, has a strong beneficial effect.

44193 (DOE/NE/34130—1-Vol.1, pp 3.103-3.120) **Review of the relation of coolant chemistry to crud deposition on light water reactor fuel.** Sheppard, K.D.; Strasser, A.A. (S.M. Stroller Corp., New York, NY). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Coolant chemistry records and fuel rod crud scrape data were compared in order to evaluate the effect of coolant chemistry on in-core crud buildup. The plants chosen for this study were two PWRs, Trojan with high crud and Beaver Valley with low crud, and two BWRs, Nine Mile Point 1 with high crud and Monticello with low crud. The objective of the study was to assist utilities in minimizing crud buildup on fuel assemblies by providing guidelines based on past experience. Chemistry data were taken from the site chemistry logs and computerized for convenience in use. Crud data were taken from reports of crud scraping campaigns. The results of the evaluation indicate that for PWRs, high pH operation such as the Westinghouse boron-lithium tradeoff curve in combination with hydrogen overpressure greater than about 25 cc (STP) per kg water, are effective in preventing crud buildup on the fuel. This mode of operation does not appear very effective in removing previously deposited crud. The results indicate that for BWRs, maintaining oxygen at an optimum level and eliminating impurities in the feedwater should result in minimizing core crud deposits.

44194 (DOE/NE/34130—1-Vol.1, pp 1.1-1.2) **Performance experience of the ASEA-ATOM BWR fuel.** Bernander, O.; Vesterlund, G. (ASEA-ATOM AB, Vaesteras, Sweden). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The ASEA-ATOM BWR fuel design is the result of an independent development effort and has pioneered several features, such as the 8 x 8 rod configuration, and the axially shaped burnable absorber, which have later been adopted by other BWR fuel vendors. ASEA-ATOM has supplied approximately 10,000 fuel assemblies of this design as initial cores and reloads of its 11 BWRs. The mechanical design of the ASEA-ATOM 8 x 8 BWR fuel is characterized primarily by: 1) cladding and channels with optimized thermo-mechanical treatment for reduced corrosion rate; 2) all-Inconel spacer with low Δp for maximum burnup capability and high core flow range; 3) a unique burnable absorber concept for power flattening and facilitating of mono-sequence operation (Gd_2O_3 content normally ranges up to 5-6%); 4) a unique fuel channel design that facilitates channel reuse; and 5) some special precautions in the fuel manufacturing, such as electron-beam end plug welding and inclined-plane gravity loading of the fuel pellets. Performance in Swedish and Finnish BWRs is discussed.

44195 (DOE/NE/34130—1-Vol.1, pp 1.3-1.15) **Trends in BWR fuel performance.** Baily, W.E.; Marlowe, M.O.; Proebstle, R.A. (General Electric Co., San Jose, CA). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

As of January 1985, General Electric has designed, fabricated and put into operation 55,000 fuel bundles containing approximately 3,200,000 fuel rods. An annual fuel rod reliability of 99.993% was achieved for the General Electric 8 x 8 lattice designs during 1983. Peak pellet exposures of GE 8 x 8 fuel irradiated in BWR's range up to 58,000 MWD/MT. The evolution of the 8 x 8 design over the last 8 years has included a number of small evolutionary changes directed at even greater fuel rod reliability coupled with improved thermal margins, lower fuel cycle costs and increased mechanical design margins for extended exposure operation. More recent design changes have focused on the elimination of Pellet Clad Interaction (PCI) as an operational failure mechanism. A new patented barrier fuel design has been developed, tested and is currently in the demonstration phase in the Commonwealth Edison Quad Cities-2 Reactor. As of January 1, 1985, over 150,000 zirconium barrier fuel rods have been loaded into operating reactors. A new, unexpected, but statistically rare failure mechanism has been observed in some BWR plants. This new failure mechanism, called Crud Induced Localized Corrosion (CILC) has been observed to cause failure in a statistically small fraction of BWR fuel rods. Actions to eliminate CILC are discussed.

44196 (DOE/NE/34130—1-Vol.1, pp 1.17-1.33) **BWR fuel performance and its development in Japan.** Inoue, K.; Oi, N.; Maki, H.; Kawada, T. (Tokyo Electric Power Company, Inc., Japan). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

At the end of 1984, fourteen BWR plants with a total electric generating capacity of 10,720 MWe are operating in Japan and the plant availability factor is more than 70%. The emphasis which has been placed on the improvement of fuel reliability has paid off well with fuel rod failure rate of BWR being in the order of 10^{-6}. Since 1978, much effort has been extended to the development of PCI (pellet-clad interaction) remedy fuel to remove plant operating restriction, so-called PCIOMR, and improve operational flexibility of reactors. After intensive R and D, a zirconium liner fuel has been found to be a good candidate and it is now planned to introduce this fuel in the near future as an improved 8 x 8 fuel type. Extension of the reactor operation cycle length and extended burnup have also become the focus of attention from the standpoint of improvement of fuel cycle cost. R and D on these subjects are in progress. In this paper, trends in BWR fuel performance and development are reviewed and future trend is also discussed. The unique integral fuel development structure at work in Japan for BWR and the support of electric utilities and government to implement this structure are singled out for their contribution to the continuing development of BWR fuel.

44197 (DOE/NE/34130—1-Vol.1, pp 1.35-1.51) **Fuel performance evaluation and improved fuel utilization by pool-site fuel services.** Knaab, H.; von Jan, R. (Kraftwerk Union Aktiengesellschaft, Erlangen, West Germany). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The paper reviews the KWU LWE fuel operating experience, the main performance results, and includes a description of the methods and equipment of related KWU fuel services. Routine pool-site measurements are made for all performance relevant dimensional changes of assemblies, fuel rods or components, and also for other important features, e.g. spring relaxation, wear and corrosion layer profiles. The data base in the high burnup range up to a peak pellet burnup of about 60 MWd/kg (U) has been significantly broadened and shows consistent trends. These data are essential for the assessment of the extended burnup capability of existing fuel types, for calibrating design models, and for developing more advanced fuel designs and loading strategies with further improvements in fuel utilization. The experience in areas of particular interest are discussed in more detail, e.g. irradiation induced growth, waterside corrosion, fretting wear, and BWR flow channel deformation. KWU fuel has achieved very high operating reliability with zero or only one leaking fuel rod per cycle in typically 90% of supplied plants. The few defects still occurring nowadays are mainly caused by system related effects. Fuel reconstitution has become an important means for improving fuel utilization on the site, and to facilitate long term storage and disposal. The respective procedures to adjust or to repair fuel assemblies are decribed.

44198 (DOE/NE/34130—1-Vol.1, pp 1.53-1.69) **Performance of Exxon Nuclear Company fuel in light water reactors.** Sofer, G.A.; van Swam, L.F.P.; Exarhos, C.A. (Exxon Nuclear Company, Inc., Richland, WA). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Exxon Nuclear Company, Inc. continues to be the only US nuclear fuel vendor with reload fuel under irradiation in both Pressurized and Boiling Water Reactors. As of December 1984, nearly one million Exxon Nuclear fabricated fuel rods have been under irradiation in thirty-two reactors in the US, Europe, and the Far East. This corresponds to 6900 fuel assemblies, distributed nearly equally between BWRs and PWRs with assembly burnups reaching approximately 48,000 MWD/MTU for PWRs and approximately 41,000 MWD/MTU for BWRs. The performance of Exxon Nuclear fuel has been consistently excellent with a fuel-related failure rate of less than 5 in 100,000 rods irradiated (or less than 4 in 1000 assemblies). Key factors contributing to this performance record include conservative design and manufacturing practices, frequent and extensive fuel performance surveillance, with rapid and appropriate design and fabrication corrections to known or potential deficiencies. Problems which have occurred have been met by prompt response which included paid on-site repair of fuel, mostly during reactor outages, with minimum impact on reactor operations. Cost effective fuel design innovations have been implemented, including the introduction of zircalloy spacers, natural uranium axial blankets and gadolinia burnable poison in PWRs; and 9 x 9 fuel for increased burnup and load following capability in BWRs. Development is underway to bring a second generation of improvements in years to come.

44199 (DOE/NE/34130—1-Vol.1, pp 1.71-1.105) **Quad Cities extended burnup fuel performance.** Crowther, R.L.; Hopkins, G.C.; Kosanke, H.D.; Ogawa, S.Y.; Shiraishi, L.M.; Yang, R.L.; O'Boyle, D.R. (General Electric Co., San Jose, CA). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Fuel assemblies containing UO_2, $UO_2Gd_2O_3$, solid pellet MO_2 and annular pellet MO_2 of two cladding thicknesses and textures were successfully irradiated to peak burnups of 57,000 MWd/MT and an 8 year residence in the Quad Cities 1 reactor under a General Electric/Commonwealth Edison/EPRI program. Peak powers were approximately 15.5 kw/ft. Sipping indicated that no fuel rod failures occurred. The irradiations were tightly regulated with the fuel assemblies kept in fixed core locations throughout their core residence. A unique peripheral assembly was irradiated with the same fuel as in the higher power central assemblies to provide a low power/temperature and cool neutron spectrum reference. Although the fuel was irradiated in a low power density BWR/3, the 7 x 7 array resulted in fuel duty prototypic of or more severe than 8 x 8 production fuel in the highest power density BWRs. The irradiations provided valuable fuel performance data and nuclear, thermal-hydraulic, fuels data for benchmarking design and evaluation computer programs.

44200 (DOE/NE/34130—1-Vol.1, pp 1.107-1.123) **Load follow operation of the Forsmark 1 and 2 BWRs.** Oevrum, S.; Nerman, H. (Swedish State Power Board, Forsmark). Apr 1985. NTIS (US Sales Only), PC A15/MF A01. File Number DE85010567. (CONF-850401—Vol.1).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Experience from Forsmark 1 and 2 has showed that load follow operation - daily or weekend - can easily be accomplished in these BWRs. Load follow operation has been extensive with 25 to 50 load swings of greater than 30% reactor power per year and reactor. No detrimental fuel behavior, e.g. fuel failures, has been observed that can be related to the load follow operation. The large flow window in ASEA-ATOM BWRs significantly facilitates load follow operation using flow control down to 60% reactor power. There is a minor capacity loss associated with the use of prescribed hold periods to mitigate xenon transient effects. The introduction of a pellet-cladding interaction (PCI) remedy will effectively reduce this capacity loss. To some extent this can also be accomplished with computer software for optimized power ascensions.

44201 (DOE/NE/34130—1-Vol.2, pp 5.29-5.42) **Performance experience of ASEA-ATOM BWR control blades.** Morlin, K.; Nordloef, S. (AB ASEA-ATOM, Vaesteras, Sweden). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

A study of all performance experience of ASEA-ATOM BWR control blades has been performed and to some extent examinations have been performed to verify the results of the study. The reason for the study was to find suggestions for further improvements and also to some extent to compare different available designs. The study was performed by ASEA-ATOM on data available from manufacturing as well as operation. The examinations have been performed at Studsvik on behalf of the Swedish utilities. The results show the importance of having detailed information about the local ^{10}B-depletion in the control blades to be able to predict the practical end of life time and the importance of large B_4C-content totally as well as locally. This is valid even if B_4C is replaced by Hf in the tip because sooner or later the critical ^{10}B-depletion will be reached in the zone immediately below the Hf-tip.

44202 (DOE/NE/34130—1-Vol.2, pp 6.1-6.16) **Overview of the joint development work on PCI remedy fuel.** Inoue, K.; Suzuki, K.; Maki, H.; Yasuda, T.; Oi, N.; Hayashi, Y.; Wakashima, Y.; Ogata, K.; Junkrans, S.; Vesterlund, G. (Tokyo Electric Power Company, Inc., Japan). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

An extensive irradiation program has been carried out since 1978 jointly between Hitachi/Toshiba (joined by Nippon Nuclear Fuel Development Co.) and ASEA-ATOM in cooperation with Japanese and Swedish utilities. The work was performed to develop pellet-cladding interaction (PCI) remedy fuel rod designs which allow reactor operation without restrictions on power increases. The performance of the improved fuel rods with various PCI remedies, i.e. Cu-barrier, Zr-liner, graphite coated and annular pellet fuel rods, was evaluated through irradiations in commercial BWRs, power ramp tests, and related examinations. Cu-barrier rods offered better performance than the reference rods. The extent of the improvement tended to decrease with burnup. Zr-liner rods, including crystal bar Zr and sponge Zr, showed remarkable PCI-resistance even at burnups higher than 30 MWd/kgU. Graphite coated fuel rods also showed remarkable PCI-resistance over the reference ones. Annular pellet rods showed good performance to reduce the degree of PCI during power ramp events.

44203 (DOE/NE/34130—1-Vol.2, pp 6.17-6.33) **International super-ramp project at Studsvik.** Mogard, H.; Heckermann, H. (Studsvik Energiteknik AB, Nykoeping, Sweden). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The pellet-clad interaction (PCI) failure propensity of experimental standard type LWR fuel rods has been studied at high fuel burnup during ramp tests in the R2 reactor at Studsvik, Sweden. A total of 44 well-characterized fuel rods have been tested: 28 rods within a PWR subprogram after base irradiation in the Obrigheim and BR-3 power reactors, and 16 rods within a BWR subprogram after base irradiation in the Wuergassen and Monticello power reactors. The burnup levels ranged from 35 to 45 MWd/kgU for the PWR fuel and from 28 to 38 MWd/kgU for the BWR fuel. Results of the BWR and PWR subprograms are presented and discussed. Interim and post ramp non-destructive and destructive examinations provided additional useful data for fuel performance analysis and modeling efforts.

44204 (DOE/NE/34130—1-Vol.2, pp 6.35-6.51) **Ramp tests on fuel rods containing solid pellet, annular pellet, and Sphere-Pac particle fuel.** Kjaer-Pedersen, N.; Woods, K.N. (Exxon Nuclear Company, Inc., Richland, WA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Exxon Nuclear Company, in cooperation with Consumers Power Company and the US Department of Energy, is carrying out a test program to evaluate possible performance benefits of several advanced fuel concepts. Base irradiations have been performed in the Big Rock Point BWR in Michigan. Following base irradiation, rod segments have been shipped to Studsvik, Sweden, for ramp testing in the R2 reactor. The investigated fuel designs include standard Exxon Nuclear BWR fuel, annular pellet fuel with and without graphite coating on the inside surface of the cladding, and Sphere-Pac fuel. The pre-pressurization level is also a variable. Ramp tests were performed in Studsvik in 1982 at 18-22 MWd/kgU, and in 1984 at 28-32 MWd/kgU. Both multiple-step and single-step ramp schemes (A and B′ ramps) were used. In 1984, a more severe testing scheme, the C ramp, was added. With the C ramp, the fuel rod is rapidly moved in the axial flux gradient to increase ramp rate and axial constraints. During all A and B′ ramps, elongation detectors were used to monitor rod length changes. Poolside nondestructive examination (NDE), including neutron radiography, was also performed. The elongation measurements and selected hot cell and NDE results have been used to further characterize the relative performance of the various designs.

44205 (DOE/NE/34130—1-Vol.2, pp 7.29-7.44) **Development of BWR 9 x 9 fuel assemblies and general trends in advanced design of LWR reload fuel.** Holzer, R.; Kilian, P.; Lill, G. (Kraftwerk Union Aktiengesellschaft, Erlangen, West Germany). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Advanced fuel designs for water reactors are aiming for improved performance mainly under the economical aspects of the fuel cycle and fuel related characteristics of plant operation. Important points are extended fuel exposure, improved fuel utilization and operating flexibility of the plant with respect to cycle length and load following. Fuel development efforts in this context include in particular the optimization of reloads, because in this way operating plants can directly participate in the results. KWU has developed a BWR 9 x 9 fuel assembly concept which has found increasing interest since the work started and which is actually an important part of BWR fuel activities. BWR 9 x 9 fuel assemblies in various types (9 x 9 with single and multiple water rods depending on the special characteristics of the individual plants) have been loaded into various BWRs starting with lead test and precursor assemblies, but already including complete batches. On the PWR side the advanced fuel include reconstitutable assemblies with neutron saving Zircaloy structure, designs with burnable poison in low leakage core configuration and 18 x 18 assemblies with reduced linear heat generation rate for operation to high burnup in a new class of plants with 1300 MWe, the so-called convoy.

44206 (DOE/NE/34130—1-Vol.2, pp 7.45-7.61) **Design and operational behavior of SVEA water cross BWR fuel.** Nylund, O.; Johansson, A.; Junkrans, S. (AB ASEA-ATOM, Vaesteras, Sweden). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The objective of the SVEA fuel development has been to realize the potential for significantly improved fuel economy in current BWRs through a more homogeneous lattice. This has been achieved by the introduction of the water cross that gives a favorable neutron flux distribution and thus increases reactivity and reduces local peaking. The cross structure also acts as a strengthening part of the channel, which has got unique mechanical characteristics and thereby contributes to further lattice improvements. The fuel rods are arranged in four 4 x 4 bundles, and the rod and spacer designs are based on the previous standard 8 x 8 fuel. The first SVEA lead test assemblies started operation in 1981 and are now in their fourth cycle. From 1984 on, commercial SVEA reloads are being introduced in Swedish BWRs giving fuel utilization savings in the order of 10% and also improved operational and safety characteristics.

44207 (DOE/NE/34130—1-Vol.2, pp 7.63-7.78) **Large scale demonstration of barrier fuel.** Rosenbaum, H.S.; Davies, J.H.; Adamson, R.B.; Tucker, R.P.; Rowland, T.C.; Paustian, H.H.; Thompson, J.R.; O'Boyle, D.R. (General Electric Co. Nuclear Energy Business Operations, San Jose, CA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

A large-scale demonstration of barrier fuel is being performed in the Quad Cities 2 reactor. The nuclear design of the demonstration and the first power ramp is described. The results of supporting tests to confirm the pellet-cladding interaction (PCI) resistance of barrier fuel and to characterize its behavior under off-normal operating conditions are presented and discussed. Barrier fuel continues to be an attractive design to achieve improved fuel cycle efficiencies.

44208 (DOE/NE/34130—1-Vol.2, pp 7.79-7.91) **Multiple ramp tests of zirconium liner fuel.** Wakashima, Y.; Ito, K.; Rosicky, E.; Oi, N.; Maki, H. (Nippon Nuclear Fuel Development Company, Ltd., Ibaraki, Japan). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Zirconium liner fuel rod segments were tested to determine the resistance of the fuel design to pellet-cladding interaction (PCI) failure in multiple power ramp tests. Five segments were initially operated in BWRs at peak powers less than 20kW/m, and then ramped to peak power levels up to 59kW/m at local exposure in the range of 7 to 23MWd/kgU. After nondestructive examination to assure their integrity, the segments were re-irradiated at a peak power of about 33kW/m during the period producing a peak exposure increase of 5MWd/kgU, and ramp tested to peak powers up to 52.5kW/m. Three of the five fuel rod segments were then again re-irradiated and re-ramp tested. There were no fuel rod failures as a result of the tests performed under this program. These severe multiple ramp test results demonstrate that the high PCI resistance of zirconium liner fuel is effective under conditions of repeated power ramping with significant irradiation exposure (deconditioning) between tests.

44209 (DOE/NE/34130—1-Vol.2, pp 7.93-7.109) **Comparison of advanced BWR fuel designs to current standard designs.** Goldstein, L.; Sheppard, K.D.; Strasser, A.A. (S.M. Stoller Corp., New York, NY). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The objective of this paper is to provide a comparison of the design features and the potential performance levels of improved fuel designs offered for BWRs. The improved designs evaluated and compared to the standard 8 x 8 fuel are: 1) P8 x 8R (GE-6) fuel with zirconium barrier clad, manufactured by General Electric; 2) 9 x 9 fuel currently being manufactured by Exxon Nuclear; and 3) 8 x 8 (QUAD+) fuel offered by Westinghouse Electric. The comparison is intended to be as generic as possible, to provide a basic guide to, and understanding of, the features of each design. As such it serves as a starting point, rather than a substitute, for a more detailed, plant specific comparison of these fuels.

44210 **(EPRI-NP—4169) Effect of feedwater oxygen control at the Vermont Yankee BWR.** Hobart, R.L.; Palino, G.F. (NWT Corp., San Jose, CA (USA)). Jul 1985. 101p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920788.

Results of a test program to evaluate the impact of oxygen injection on the release and transport of iron, nickel, cobalt, copper and zinc in the feedwater system at the Vermont Yankee boiling water reactor (BWR) are presented. Design and operation of the oxygen injection system are discussed. Conclusions and recommendations relative to generic application of oxygen injection for corrosion product control in BWRs during normal operation are presented. Application of oxygen injection to assist in feedwater system materials passivation after an extended outage also is discussed. 12 refs., 16 figs., 5 tabs.

44211 **(EPRI-NP—4208) Longevity of nuclear power systems. Final report.** Spiewak, I.; Livingston, R.S. (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1985. 148p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920799.

This study considers the feasibility of extending the life of existing nuclear power plants and concludes that power reactors should have useful service lives substantially in excess of the licensed 40 years from the date of the construction permit. The technical areas requiring attention from utilities and/or research and development by EPRI were reviewed. Utilities should begin now to study the applicability of life extension to their respective plants. Strategies to control fast neutron irradiation of reactor vessels should be implemented where necessary. Utilities should focus more strongly on improving plant reliability and availability, and properly documenting plant performance. They should provide for the availability of critical replacement and spare parts. Research on the performance, surveillance and repair of reactor pressure vessels should be continued. The possibility of establishing electrical cable lifetimes of 60 years or more in reactor service should be investigated. Generic methods of verifying and maintaining the continued integrity of concrete structures are needed. Techniques for maintaining and monitoring most other plant systems and components appear to be available. Finally, EPRI and the Department of Energy have initiated two plant specific projects at Virginia Power's Surry plant, a PWR, and at Northern States Power's Monticello plant, a BWR.

44212 **(NUREG/CR—1197) Heavy-section steel technology program. Quarterly progress report, July-September 1979.** Whitman, G.D.; Bryan, R.H. (Oak Ridge National Lab., TN (USA)). Apr 1980. Contract AC05-84OR21400. 102p. (ORNL/NUREG/TM—370). NTIS, PC A06/MF A01 - GPO. File Number TI85015881.

The program comprises studies related to all areas of the technology of the materials fabricated into thick-section primary-coolant containment systems of light-water-cooled nuclear power reactors. The principal area of investigation is the behavior and structural integrity of steel pressure vessels containing cracklike flaws. Currents work is organized into six tasks: (1) program administration and procurement, (2) fracture mechanics analyses and investigations, (3) effect of high-temperature primary reactor water on the subcritical crack growth of reactor vessel steels, (4) investigations of irradiated materials, (5) pressure vessel investigations, and (6) thermal shock investigations. A finite-element computer program for calculating mixed-mode stress-intensity factors for nozzle-corner flaws of arbitrary shape is being checked. A standard crack-arrest toughness testing method is being developed. Charpy impact and J-integral test data were obtained for irradiated weld metal. Preparation for an intermediate vessel test of low-upper-shelf material commenced. The first large-cylinder thermal shock test was performed.

44213 (NUREG/CR—1912) Characterization and evaluation of a turbine disc section containing a service crack. Goldberg, A.; Albertson, S.L.; Fedrick, I.A. (Lawrence Livermore National Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 39p. (UCID—18699). NTIS, PC A03/MF A01 - GPO. File Number TI85016008.

Cracking had occurred in the keyway of a low-pressure turbine disc from Cooper. We evaluated a section of the disc to determine whether the tensile and Charpy V-notch (CVN) toughness properties in the hub region corresponded to those originally specified for this disc. We also characterized the microstructure of the steel and analyzed the bore surface. Room-temperature tensile properties and $FATT_{50}$ were found to be essentially unchanged from the specified values. The steel was relatively clean. However, excessive segration was present and was reflected by variations in grain size, microhardness, sulfur distribution, and inclusion content. Using x-ray analysis, we identified the presence of an MoS_2 deposit and an $FeCr_2O_4$ corrosion film along the bore. We propose that excessive segregation (inclusions, alloying elements, embrittling constituents) contributes to excessive scatter in our CVN results. Segregation and MoS_2 lubricant may both contribute to the cracking problem.

44214 High-speed BWR power plant simulations on the special-purpose peripheral processor AD10. Wulff, W.; Cheng, H.S.; Lekach, S.V.; Mallen, A.N. (Brookhaven National Lab., Upton, NY (USA)). pp 21-30 of Simulation for nuclear reactor technology. Proceedings of the international conference, Robinson College, Cambridge, 9-11 April 1984. Walton, D.G. (Manchester Univ. (UK). Simon Engineering Labs.) (ed.). Cambridge, England; Cambridge University Press (1985). (CONF-840409—).

From Conference on simulation for nuclear reactor technology; Cambridge, UK (9 Apr 1984).

Price Pound 35.00.

A newly developed technique is described for fast, on-line simulations of normal and accidental transients in nuclear power plants. The technique is based on the utilization of the special-purpose peripheral processor AD10, which is specifically designed for high-speed systems simulations through integration of large systems of nonlinear ordinary differential equations. The Peach Bottom-II Boiling Water Reactor power plant has been simulated and results are presented. It is shown that the new technique not only advances safety analyses but also supports plant monitoring, failure diagnosis and accident mitigation, as well as the training of nuclear power plant operators.

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REFER ALSO TO CITATION(S) 43858, 44181, 44182, 44183, 44185, 44186, 44188, 44189, 44190, 44193, 44197, 44198, 44203, 44205, 44211, 44212, 44277, 44312, 44314, 44315, 44316, 44318, 44319, 44344, 44346, 44349, 44351, 44353, 44356, 44360, 44365, 44369, 44370, 44371, 44372, 44375, 44376, 44377, 44379, 44381, 44383, 44384, 44385, 44389, 44390, 44394, 44395, 44396, 44397, 44401, 44402, 44403, 44404, 44407, 44408, 44409, 44411, 44412, 44414, 44417, 44428, 44429, 44430, 44431, 44432, 44433, 44434, 44439, 44441, 45017, 45121

44215 (BNL-NUREG—36108) Investigation of corrosion and stress corrosion cracking in bolting materials on light water reactors. Czajkowski, C.J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-850809—47). NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number TI85010232.

From 8. international conference on structural mechanics in reactor technology; Brussels, Belgium (19 Aug 1985).

Laboratory experiments performed at BNL have shown that the concentration of boric acid to a moist paste at approximately the boiling point of water can produce corrosion rates of the order of several tenths of an inch per year on bolting and piping materials, which values are consistent with service experience. Other failure evaluation experience has shown that primary coolant/lubricant interaction may lead to stress corrosion cracking (SCC) of steam generator manway studs. An investigation was also performed on eleven lubricants and their effects on A193 B7 and A540 B24 bolting materials. H_2S generation by the lubricants, coefficient of friction results and transgranular SCC of the bolting materials in steam are discussed. 13 refs.

44216 (CEA-R—5281) Modelisation of soluble aerosols behaviour in the atmosphere of a PWR nuclear reactor in case of accident. Abbas, A.F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-12 Univ., 94 - Creteil (France)). Jul 1984. 213p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751197.

After a short description of soluble aerosols accidental production in a PWR, a calculation model is given for physical properties of a gaz and steam mixture in a given atmosphere. Then the equilibrium of a saline drop with steam is studied. From the MASON equation, a calculation model is given for kinetic of volume variation of a saline drop and also a sensitivity study showing the little influence of the boundary layer on the drop surface, of the drop settling and of the thermodynamic conditions of the containment. As a numerical application, this condensation/evaporation model, and a simplified one with faster numerical resolution, is introduced in the AEROSOLS codes of the CEA-DEMT. The AEROSOLS/A2 suppose a log-normal distribution of the suspended particles in the containment. This application shows the very large sensitivity of the condensation depending on the moisture ratio inside the reactor building, and its primary importance on the behaviour of the aerosols. It is also shown that the simplified model gives a very little difference compared with the detailed model, and that the computation time is much more lower.

44217 (DOE/NE/34130—1-Vol.2, pp 4.1-4.18) Release and migration of fission products in high burnup fuel. Bain, G.M.; McInteer, W.A.; Papazoglou, T.P. (Babcock and Wilcox Co., Lynchburg, VA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2). Contract AC02-78ET34212.

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The release of fission products from UO_2 fuel has been investigated at assembly average burnups ranging from 30-50 GWd/mtU as part of a DOE sponsored extended burnup program. The program was designed to study the performance of the B and W 15 x 15 fuel assembly design through five cycles of irradiation. This paper provides an analysis of the observed fission product behavior in the high burnup fuel. The data were obtained from hot cell examinations of fuel rods from three sibling fuel assemblies irradiated in the Oconee-1 reactor for 3, 4, and 5 cycles, respectively. Plenum gas analysis, fuel microscopy, and microsampling were performed on the high burnup, 5-cycle fuel to characterize the distribution of fission products. The data generated in the fifth-cycle examination were compared to those of previous examinations of 3- and 4-cycle fuel rods. Fission gas release from the 5-cycle rods was below 4%. The fractional fission gas release (0.7% - 3.8%) correlated with rod position within the assembly and, therefore, may be attributed to small differences in the rod power histories. The fuel exhibited irradiation-induced changes in the microstructure consisting of some limited grain growth, changes in porosity, and metallic fission product inclusions. The pellet-cladding interface showed a reaction layer that occurred during the extended burnup operation (cycles 4 and 5).

44218 (DOE/NE/34130—1-Vol.2, pp 4.19-4.32) Fission gas release from PWR fuel rods at extended burnups. Pati, S.R.; Garde, A.M. (Combustion Engineering, Inc., Windsor, CT). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Measurements of fission gas release are presented for helium-pressurized fuel rods of PWR design that were all fabricated using Zircaloy-4 tubing and solid UO_2 fuel pellets. Various fuel microstructures are included, which have distinct differences in grain size, density, porosity distribution and propensity for in-reactor densification. One group of gas release measurements is from fuel rods irradiated for one to five cycles at Calvert Cliffs 1. These measurements show that up to 2% fission gas release, based on the end-of-life inventory, can be expected from the fuel pellets in modern PWR fuel rods for normal operating conditions to burnups at least as high as 54 GWd/mtU. The results presented for the Calvert Cliffs 1 rods are consistent with measurements of gas release from

Fort Calhoun fuel rods and from fuel rods from five other PWRs up to a burnup of about 50 GWd/mtU. The availability of these data has improved the understanding of fission gas release behavior under normal PWR operating conditions and has reduced the conservatism in prediction of gas release at high burnups. Another group of gas release measurements is presented for pressurized PWR fuel rodlets which have undergone fast power ramps in test reactors at Studsvik and HFR Petten, following up to four cycles of power reactor irradiation. Results are compared with those of the Calvert Cliffs measurements.

44219 (DOE/NE/34130—1-Vol.2, pp 4.33-4.49) **Fission gas release of PWR fuel under steady and transient conditions up to high burnup.** Manzel, R.; Sontheimer, F.; Stehle, H. (Kraftwerk Union Aktiengesellschaft, Erlangen, West Germany). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Integral and local fission gas release/retention-measurements have been performed on standard PWR fuel rods and fuel rod segments operated at steady as well as at transient power conditions up to rod average burnups of 53 GWd/tU. Standard fuel rod fission gas puncturing techniques and mass spectrometric analyses have been used to determine the integral amount of fission gas released and its composition. Micro-γ-scanning and microsampling techniques have been applied to determine the radial distribution of retained fission gases and solid fission products within a pellet and to measure their absolute concentration. The integral fractional fission gas release of PWR fuel rods after steady operation was found to be low in general. However, there is a tendency of increasing fractional release with increasing burnup if fuel centerline temperatures remained relatively constant (centerline temperature $\approx$1250°C). The local fission gas release starts around 1200°C (burnup $<$ 25 GWd/tU) and reaches a maximum of about 90% after 1 hour at 1900°C or after 50 hours at 1600°C. No significant further increase in the fractional release has been found for fuel operated at even higher temperatures, thus indicating a saturation at about 90%.

44220 (DOE/NE/34130—1-Vol.2, pp 4.51-4.52) **Evaluation of high burnup fission gas release data.** Weiner, R.A. (Westinghouse Electric Corp., Pittsburgh, PA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Fission gas release from irradiated fuel pellets plays an important role in determining fuel rod performance. Heat transfer and fuel temperatures are affected by changes in the composition and pressure of the rod fill gases, and the gas pressure has a major effect on the cladding stresses and strains. The ability to predict fission gas release at high burnup thus plays a critical role in extending fuel rod performance limits. This paper discusses high burnup fission gas release data from several fuel rod irradiation tests, with particular attention paid to the evidence for burnup enhancement of the fission gas release. The fission gas release data cover a wide range of road fabrication variables and irradiation conditions: non-densifying and densifying fuel, pressurized and unpressurized rods and cycle average rod powers ranging from 3 to 12 kW/ft. Rod average burnups of up to 48 GWD/MTU have been obtained for rods operating at low to moderate power levels typical of these in normal reactor operation, while burnups over 60 GWD/MTU have been achieved with highly enriched fuel operating at high power levels in special test assemblies. Modelling of fission gas release can be separated into two regimes based on fuel temperature. At low temperatures fission gas release is due to a thermal knockout and recoil processes. In the high temperature regime, fission gas release occurs through rapid migration of fission gas to grain boundaries and the formation of an interlinked network of fission gas bubbles on the grain edges.

44221 (DOE/NE/34130—1-Vol.2, pp 4.53-4.68) **Mechanisms of fission gas release from different types of fuel rods during normal operation: results and analysis of CONTACT experiments.** Charles, M.; Chenebault, P.; Melin, P. (Centre d'Etudes Nucleaires de Grenoble, France). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The CONTACT experiments, which were carried out by CEA (SILOE Reactor, Grenoble, France) within the framework of a CEA-FRAMATOME-FRAGEMA collaboration agreement, concern the behavior of in-pile irradiated PWR fuel rods. This paper deals with the results of fission gas release measurements. The experimental device is briefly described, then the influence of various parameters is reported first for stable gas release (linear rating - geometry), then for radioactive gas release (decay constant from 1.5×10^{-6} to $3.6 \times 10^{-3} s^{-1}$, burnup, centerline fuel temperature, nature and pressure of the filling gas). Moreover, the influence of the initial fuel specific surface is underlined. The experimental results are discussed with reference to typical observations concerning low as well as high temperature release. The analysis of the role of knock-out is shown to be worthwhile. Some useful contributions to gas release modelling are derived.

44222 (DOE/NE/34130—1-Vol.2, pp 5.1-5.11) **Materials development and irradiation testing of a boride integral fuel burnable absorber.** Cunningham, S.E.; Radford, K.C.; Keller, H.W. (Westinghouse Electric Corp., Pittsburgh, PA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

A new Integral Fuel Burnable Absorber which incorporates boron inside the fuel rod has been developed and tested. This new absorber is a thin boride coating adherent to the uranium fuel pellet. Recently, the performance of these coatings has been evaluated from a materials standpoint in two separate irradiation tests. Measurements have shown that the boride coating remains structurally intact throughout its functional lifetime (one cycle of operation). Other irradiation tests and demonstrations already in place are intended to show there are no adverse effects of the presence of the coating on the fuel throughout the fuel lifetime. The development, irradiation testing and demonstration of thin boride absorber films is progressing rapidly towards verification of a commercially viable alternative to other in-fuel-rod absorbers.

44223 (DOE/NE/34130—1-Vol.2, pp 5.13-5.27) **Irradiation behavior of neutron absorber materials in Combustion Engineering's burnable poison and control elements.** Fuhrman, N.; Ruzauskas, E.J.; Smith, G.P. Jr. (Combustion Engineering, Inc., Windsor, CT). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The irradiation behavior of the neutron absorber materials used in the burnable poison and control elements of pressurized water reactors designed by Combustion Engineering (C-E) has been characterized in a number of different post-irradiation examination programs. The major objectives were: 1) to verify the performance of components used for reactivity control, and 2) to extend the materials behavior data base to high exposure. Nondestructive examinations at reactor sites and destructive examinations at a hot cell provided data on the Al_2O_3-B_4C burnable poison rods and hybrid (Ag-In-Cd/B_4C) control rods that are currently used in C-E reactors. These showed that the swelling and helium release behavior of Al_2O_3-B_4C was similar to that reported by other investigators for an exposure of one power reactor cycle. More importantly, exposures of up to four irradiation cycles resulted in no significant change in total helium release beyond one cycle while the swelling of the Al_2O_3-B_4C appeared to be effectively restrained by the Zircaloy-4 cladding. An investigation of the loss of B_4C from a perforated burnable poison rod suggested that interconnected porosity promoted the leaching of B_4C particles from the Al_2O_3 matrix.

44224 (DOE/NE/34130—1-Vol.2, pp 5.43-5.49) **Performance of Exxon Nuclear gadolinia-bearing fuel in pressurized water reactors.** Skogen, F.B.; Killgore, M.R. (Exxon Nuclear Company, Inc., Richland, WA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Cost effective fuel management plans and the interest in longer operating cycles for pressurized water reactors place increased emphasis on efficient utilization of burnable absorbers for power distribution shaping and reactivity control. Gadolinia-bearing fuel has benefits over other forms of burnable absorbers and significantly increases the flexibility of the fuel cycle design. Exxon Nuclear Company, Inc. has successfully demonstrated the utilization of gadolinia-bearing fuel for concentrations consistent with the requirements of eighteen-month cycle designs. A total of about 2800 gadolinia-bearing fuel rods has been supplied to and operated in eight(8) pressurized water reactors. Maximum assembly burnups approaching 42,500 MWD/MT have been achieved by gadolinia-bearing fuel assemblies. Performance predictions have agreed well with measurements for reloads relying on gadolinia as the burnable absorber. No known fuel failures have occurred in these rods.

44225 (DOE/NE/34130—1-Vol.2, pp 5.51-5.63) **Analysis of thermomechanical behavior of UO_2 Gd_2O_3 fuel under irradiation conditions.** Bruet, M.; Porrot, E.; Trotabas, M.; Melin, P.; Bonnaud, E. (Commissariat a l'Energie Atomique, Grenoble, France). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The CEA (French Atomic Energy Commission) and FRAGEMA are performing an important joint program to investigate the in reactor thermomechanical behavior of PWR's UO_2 Gd_2O_3 fuel rods. This objective is obtained by two complementary means: 1) analytical experiments where instrumented UO_2 Gd_2O_3 rods are irradiated in the test reactor SILOE (GDGRIF experiments), and 2) overall experience issued from the irradiation since 1976 of many UO_2 Gd_2O_3 rods in both experimental PWR's, CAP CEA test reactor in Cadarache and BR-3 reactor. The first GDGRIF experiment with 5 wt% gadolinia is achieved and the second with 8 wt% gadolinia is underway. The analysis of the first results indicate that the effect of gadolinium on thermal conductivity is lower than reported up to now in the literature. The post-irradiation examinations achieved on UO_2 Gd_2O_3 fuel rods irradiated in the CAP and BR-3 reactors have shown that a 3 wt% Gd_2O_3 content, as scattered particles or homogeneously mixed has no adverse effect on the fuel behavior up to local burnup of 39 GWd/tU and to local power of 37 kW/m.

44226 (DOE/NE/34130—1-Vol.2, pp 6.53-6.68) **Ramp test behavior of high burnup PWR fuel rods.** LaVake, J.C.; Gaertner, M. (Combustion Engineering, Windsor, CT). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

The objective of the High Burnup PWR Ramp Test Program was to investigate the behavior of high burnup PWR type fuel under fast power ramp conditions. The program, which has been completed, was sponsored by the US Department of Energy and was performed by Combustion Engineering and Kraftwerk Union in cooperation with Kernforschungsanlage Juelich and the Joint Research Centre Petten. The program consisted of two parts. Part 1 reported ramp test results from 68 rodlets with one to three cycles of power reactor exposure. Part 2, the subject of this paper, evaluated the ramp behavior from 18 ramp tests on rodlets with high burnups ranging from 30 to 46 GWd/mtU (three and four cycles of power reactor exposure). The results of Part 2 indicate that the high burnup rods showed very good resistance to PCI damage during ramp testing. Furthermore, two re-ramp tests included in Part 2 indicate, albeit without statistical significance, that once a fuel rod has reached a given power, it can attain that power again without failing, even after considerable additional burnup.

44227 (DOE/NE/34130—1-Vol.2, pp 6.69-6.82) **Fuel behavior, fission product release and cladding deformation during the CANSAR, PCI-related experiment.** Lemaignan, C.; Porrot, E.; Bruet, M.; Joseph, J. (Centre d'Etudes Nucleaires de Grenoble, France). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Within the context of the CANSAR irradiation, the behavior of two identical PWR fuel rods was analyzed during power ramping at different levels. Both were loaded with various types of pellets. One was instrumented with strain gauges, centre-line thermocouples and gas collection lines, while the other was standard and removable for non-destructive examination between pile cycles. The experiment is described and results are presented: fission product release, fuel cladding contact, fuel expansion and creep, and cladding deformation. A discussion is developed on the reliability of this type of experiment and its interest for a better understanding of the mechanisms involved during pellet-cladding interaction.

44228 (DOE/NE/34130—1-Vol.2, pp 7.1-7.12) **Design and demonstration of the Fragema advanced fuel assembly (AFA).** Grattier, B.; Dehon, C.; Leclercq, J.; Wattaeu, M. (Fragema, Lyon, France). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

Fragema is now proposing the advanced fuel assembly (AFA) assembly for use in the Framatome PWR 900 reactors having 12 ft cores. This new assembly will progressively replace the current 17 x 17 assembly, which has been the basic fuel element, since the PWR reactors have been operating in France. AFA has kept the same fuel rods as in the current design (this reference fuel rod combines a long time successful experience in reactor and a worthy economic performance especially in the range of discharge burnup presently considered) whereas its structure provides two main improvements: spacer grid straps of Zircaloy and dismantability available at both ends of the assembly. In this way, four advantages can be got from AFA: 1) low enrichment (less neutron absorber parasitic materials in the grid than in the current design), 2) favorable reduction effect on the coolant activity (less amount of the Cobalt released in the coolant due to less Inconel in the grid), 3) expectation of a high level of AFA fuel rod integrity (demonstrated by the large successful experience performed in French reactors with this type of fuel rod on the current assembly), and 4) less risk of energy loss by damaged fuel assemblies (dismantability enables them to be easily repaired and then reloaded for further operation in reactor while the primary coolant is kept clean by eliminating leaking rods).

44229 (DOE/NE/34130—1-Vol.2, pp 7.13-7.28) **Demonstration of the VANTAGE 5 fuel design.** Leasure, R.A.; Smalley, W.R.; Rowland, D.M.; DeMario, E.E. (Westinghouse Electric Corp., Pittsburgh, PA). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

A demonstration program is underway to show that all irradiation effects have been considered in the design of Westinghouse VANTAGE 5 PWR fuel. The program includes irradiation of demonstration fuel assemblies in commercial reactors as part of the overall design verification process before its commercial use. The demonstration of this fuel incorporates prior fuel experience and data from the demonstration programs for the optimized fuel assembly and the integral fuel burnable absorber. The VANTAGE 5 demonstration fuel assemblies include one assembly with intermediate flow mixer grids only and four assemblies with all VANTAGE 5 features (intermediate flow mixer grids, axial blankets, integral fuel burnable absorbers, increased burnup capability, and reconstitutable top nozzle). Extensive as-fabricated measurements of the fuel pellet and fuel rod and assembly characteristics form a preirradiation data base for evaluation of irradiation effects that may be observed in postirradiation examinations. The VANTAGE 5 demon-

stration assemblies will have completed at least one cycle of irradiation before a full region delivery. The out-of-reactor tests and the demonstration program have shown that all VANTAGE 5 design requirements have been satisfied.

44230 (EPRI-NP—4061M) Nature of corrosion films in simulated LWR water. Final report. Lumsden, J.B. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Jun 1985. 21p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920833.

Passive films on Alloy 600 and Type 304 stainless steel were characterized using surface analysis instruments. The films were formed under conditions suspected of causing cracking in nuclear systems and compared to those formed under conditions where cracking does not occur. Alloy 600 was investigated in the boric acid-lithium hydroxide thiosulfate solution. Susceptibility to stress corrosion cracking was correlated with the occurrence of a film containing sulfide ions. Environmental conditions which produce an oxide film do not cause stress corrosion cracking of Alloy 600 in the system studied. Type 304 stainless steel was investigated in high purity water at 288°C having levels of dissolved O_2 where Type 304 stainless steel is susceptible and not susceptible to stress corrosion cracking. A correlation was found between passive film chemistry and susceptibility to stress corrosion cracking.

44231 (KFK—3864) Economics of an advanced pressurized water reactor (APWR). Klumpp, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1985. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85751910.

Limited natural uranium resources together with their low utilization in current lightwater reactors (LWR) on the one hand and the high capital investments for a LWR and fast breeder reactor system resulting in a high fuel utilization are the most important reasons for research and development (R+D) work related to a high converting APWR system. It is the main task of this analysis to study the economic behaviour of an APWR combining its technical and physical parameters with an economic data base. After introductional remarks chapter II presents the potential improvements of the uranium utilization and their importance for a whole national economy. Chapter III shows the micro-economic aspects for an electricity producing utility using such an APWR plant. The chapter is restricted to the fuel cycle costs and their dependence on various parameters. The corresponding costs of other nuclear power plants are described in chapter IV and compared to those of the APWR in chapter V. Finally a cost comparison on the basis of the electricity generating costs will complete the economic picture of an advanced pressurized water reactor.

44232 (NUREG/CR—1603) Evaluation of cracking in feedwater piping adjacent to the steam generators in Nine Pressurized Water Reactor Plants. Goldberg, A.; Streit, R.D.; Scott, R.G. (Lawrence Livermore National Lab., CA (USA)). 25 Jun 1980. Contract W-7405-ENG-48. 198p. (UCRL—53000). NTIS, PC A09/MF A01 - GPO. File Number TI85015909.

Cracking in ASTM A106-B and A106-C feedwater piping was detected near the inlet to the steam generators in a number of pressurized water reactor plants. We received sections with cracks from nine of the plants with the objective of identifying the cracking mechanism and assessing various factors that might contribute to this cracking. Variations were observed in piping surface irregularities, corrosion-product, pit, and crack morphology, surface elemental and crystal structure analyses, and steel microstructures and mechanical properties. However, with but two exceptions, namely, arrest bands and major surface irregularities, we were unable to relate the extent of cracking to any of these factors. Tensile and fracture toughness (J/sub Ic/ and tearing modulus) properties were measured over a range of temperatures and strain rates. No unusual properties or microstructures were observed that could be related to the cracking problem. All crack surfaces contained thick oxide deposits and showed evidence of cyclic events in the form of arrest bands. Transmission electron microscopy revealed fatigue striations on replicas of cleaned crack surfaces from one plant and possibly from three others. Calculations based on the observed striation spacings gave a value of $\Delta\sigma = 150$ MPa (22 ksi) for one of the major cracks. The direction of crack propagation was invariably related to the piping surface and not to the piping axis. These two factors are consistent with the proposed concept of thermally induced, cyclic, tensile surface stresses. Although surface irregularities and corrosion pits were sources for crack initiation and corrosion may have contributed to crack propagation, it is proposed that the overriding factor in the cracking problem is the presence of unforeseen cyclic loads.

44233 (NUREG/CR—1606) Evaluation of condensation-induced water hammer in preheat steam generators. Saha, P.; Ginsberg, T.; Wu, B.J.C.; Jones, O.C. Jr. (Brookhaven National Lab., Upton, NY (USA)). Sep 1980. Contract AC02-76CH00016. 90p. (BNL-NUREG—51248). NTIS, PC A05/MF A01 - GPO $3.75. File Number TI85015921.

A review of Westinghouse 1/8-scale water hammer tests and data analysis was carried out. BNL has concluded that water hammers occurred in the feedwater line during many of the 1/8-scale tests. These events were probably caused by steam bubble entrapment and collapse in the partially-filled feedwater line. Recorded vessel pressure pulse activity under two-phase operating conditions was rare and, in those cases where pulses were recorded, the pressure pulse amplitudes were small. Either void collapse water hammers are unlikely events under these two-phase conditions, or events that did occur were attenuated in magnitude by the two-phase medium and internal structures before the pulse reached the pressure transducer. Pressure pulse attenuation in two-phase air-water media was studied experimentally at BNL. It was found that no significant attenuation could be detected in two-phase flows over distances of approximately 1 to 2 ft. The effects of internals, however, were not considered. The Westinghouse scaling laws have also been critically reviewed. An independent BNL analysis was carried out to verify the Westinghouse scaling laws. It has been found that the present state-of-the-art on the condensation heat transfer and the mechanism of vapor cavity formation precludes us from deriving any credible scaling criteria. However, it was found that under certain operating conditions the condensation-induced void collapse could be an oscillatory process. This may partially explain the apparent randomness of the water hammer phenomenon seen in most experimental studies.

44234 (NUREG/CR—1828) Eddy-current inspection for steam generator tubing program. Quarterly progress report, March 31, 1980. Dodd, C.V.; Deeds, W.E.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Dec 1980. Contract AC05-84OR21400. 10p. (ORNL/NUREG/TM—420). NTIS, PC A02/MF A01 - GPO. File Number TI85015928.

Eddy-current methods provide the best in-service inspection of steam generator tubing, but present techniques can produce ambiguity because of the many independent variables that affect the signals. The current development program has used mathematical models and developed or modified computer programs to design optimum probes, instrumentation, and techniques for multifrequency, multiproperty examinations. Interactive calculations and experimental measurements have been made with the use of modular eddy-current instrumentation and a minicomputer. These establish the coefficients for the complex equations that define the values of the desired properties (and the attainable accuracy) despite changes in other significant variables. The computer programs for calculating the accuracy with which various properties can be measured indicate that the tubing wall thickness and the defect size can be measured much more accurately than is currently required, even when other properties are varying. Our experimental measurements have confirmed these results, although more testing is needed for all the different combinations of cases and different types of defects. We are continuing to design and construct instrumentation systems that will be used in the field.

44235 (NUREG/CR—1958) Evaluation of multiparameter eddy current technology for inspection of steam generator tubing. Brown, S.D. (Battelle Columbus Labs., OH (USA)). Mar 1981. Contract AC02-76CH00016. 84p. (BNL-NUREG—51347). NTIS, PC A05/MF A01 - GPO. File Number TI85016009.

Multifrequency/multiparameter eddy current instrumentation for inspection of steam generator tubing has recently become commercially available. The instrumentation offers the steam generator owner a means to conduct parallel tests, i.e., normal tube integrity tests, sludge profiling and dent sizing in one pull through the tube. In addition, the real time suppression of extraneous variables such as support plates, denting and ID noise can be accomplished. The intercontrole IC3FA multiparameter instrument has been used for an assessment of multiparameter technology to detect and characterize defects in the presence of extraneous variables. A general mixing sequence has been developed which is applicable to both recirculating steam generators (RSG) and once-through steam generators (OTSG). Candidate mixing frequencies have been identified through the use of a computer program which models the IC3FA sequential mixing network. Using appropriate models of defects at support plates and dented support plates, multiparameter technology has been found to offer advantages over single frequency approaches for more reliable defect detection and characterization.

44236 **(NUREG/CR—2149) Eddy-current inspection for steam generator tubing program. Annual progress report, December 31, 1980.** Dodd, C.V.; Deeds, W.E.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Aug 1980. Contract AC05-84OR21400. 18p. (ORNL/TM—7836). NTIS, PC A02/MF A01 - GPO. File Number TI85016037.

Eddy-current methods provide the best in-service inspection of steam generator tubing, but present techniques can produce ambiguity because of the many independent variables that affect the signals. The current development program has used mathematical models and developed or modified computer programs to design optimum probes, instrumentation, and techniques for multifrequency, multiproperty examinations. To facilitate the extensive laboratory scanning of the matrix of specimens that are necessary to develop algorithms for detection and analysis for all the possible combinations of positions of flaws, tube supports, and probe coils, we have designed, constructed, and used a computer-controlled automatic positioner. We have calibrated the instrumentation on an array of standard samples and used these measurements to formulate the algorithms for determining the desired properties. We have outfitted a mobile laboratory, mounted in a pickup truck, and we have successfully inspected steam generator tubes at the Robert E. Ginna and Point Beach reactors.

44237 **(NUREG/CR—2305-Vol.1) Eddy-current inspection for Steam Generator Tubing Program. Quarterly progress report for period ending March 31, 1981. Volume 1.** Dodd, C.V.; Deeds, W.E.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Oct 1981. Contract AC05-84OR21400. 15p. (ORNL/TM—7954-Vol.1). NTIS, PC A02/MF A01 - GPO. File Number TI85015993.

Eddy-current methods provide the best in-service inspection of steam generator tubing, but these techniques can produce ambiguity because of the many independent variables that affect the signals. The current development program has used mathematical models and has developed or modified computer programs to design optimum probes, instrumentation, and techniques for multifrequency, multiproperty examinations. Interactive calculations and experimental measurements have been made with the use of modular eddy-current instrumentation and a minicomputer. These establish the coefficients for the complex equations that define the values of the desired properties (and the attainable accuracy) despite changes in other significant variables. The computer programs for calculating the accuracy with which various properties can be measured indicate that the tubing wall thickness and the defect size can be measured much more accurately than is currently required, even when other properties vary. Our experimental measurements have confirmed these results. We have made measurements at scheduled field inspections of the Ginna and Point Beach steam generators and have obtained excellent data. We are continuing to improve the equipment and the data-processing systems. 13 figs.

44238 **(NUREG/CR—3952) Sequoyah equipment hatch seal leakage. Final report, February 1985.** Greimann, L.; Fanous, F.; Bluhm, D. (Ames Lab., IA (USA)). Feb 1985. Contract W-7405-ENG-82. 45p. (IS—4862). NTIS, PC A03/MF A01 - GPO. File Number TI85011358.

The Sequoyah equipment hatch should not leak before strains of several percent develop in the 1/2-inch containment shell plate near the springline, which occurs between 50 and 60 psi. In the unlikely event of hatch buckling, postbuckling deformations would not introduce leakage.

44239 **(NUREG/CR—4300-Vol.1) Acoustic emission/flaw relationship for in-service monitoring of nuclear pressure vessels. Progress report, October 1984-March 1985. Volume 1.** Hutton, P.H.; Kurtz, R.J. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 26p. (PNL—5511-Vol.1). NTIS, PC A03/MF A01 - GPO. File Number TI85016647.

Technical progress in developing continuous acoustic emission (AE) monitoring of nuclear reactor pressure boundaries for flaw detection is discussed in this report. Topics include final analysis of ZB-1 vessel test data, preparation for continuous AE monitoring of Watts Bar Unit 1 reactor during operation, AE signal pattern recognition development, and development of an ASTM standard for application of continuous AE monitoring to pressure boundaries.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 44612, 44713

44240 (Juel-Conf—49, pp 12-19) **Warm-moulded graphitic matrix for spherical HTR fuel elements.** Schulze, R.E.; Delle, W.; Binkele, L.; Haag, G.; Schulze, H.A.; Rind, W. Jun 1984. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). (CONF-8407143—Exc.).

From International carbon conference; Bordeaux, France (2 Jul 1984).

In order to enable the manufacture of fuel elements with high heavy-metal loading, as well as to improve the fabrication technology, the NUKEM/HOBEG company developed a process for the warm-moulding of the elements using a pitch coke graphite as basic raw material for the graphitic matrix. The material properties and behaviour before and after neutron irradiation of the standard quality of the warm-moulded matrices were compared with those of the cold-moulded fuel matrices.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 44308, 44332, 44336, 44337, 44338, 44357, 44358, 44736

44241 **(AECL—6816) Methods for analysing substitution experiments in thermal reactors.** Carlson, P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Feb 1984. 108p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701989.

Some of the techniques used to interpret fuel-element substitution experiments in thermal neutron reactors are reviewed and the conditions under which they are most appropriately used are examined. The emphasis is on heavy-water-moderated reactors with application to thorium-plutonium fuels in a uranium drive lattice. Methods are compared for their relative speed and accuracy in obtaining test-region bucklings and spectral interaction effects from experimental data for widely differing lattices.

44242 **(AECL—7079) AECL research programs in systems chemistry.** Lister, D.H.; Pathania, R.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702005.

Research programs in Systems Chemistry are aimed at preserving the integrity of the many working systems in CANDU reactors and at minimizing chemistry-induced problems such as radiation field growth or fouling of surfaces. The topics of main concern are the chemistry and corrosion of steam generators, for it is

in this general area that the potential for serious problems is very real.

44243 **(AECL—7544) MULTICELL - a 3-D program for the simulation of reactivity devices in CANDU reactors.** Dastur, A.R.; Buss, D.B. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). Feb 1983. 79p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85701990.

This report describes the coupling of diffusion and integral transport theory to the determination of reaction rates in the neighborhood (supercell) of reactivity devices in heavy water reactor lattices. The method is about 200 times faster than integral transport methods, and produces nearly identical results. The equivalent (supercell) cross sections so generated, enable a standard diffusion theory analysis to reproduce measured flux distortions and reactivity changes to 5 percent or better. Depending on the size of the model, computation costs for equivalent cross sections are typically $5 to $25/case on the CDC-6600.

44244 **(AECL—7781) Kinetics of iodine and cesium reactions in the CANDU reactor primary heat transport system under accident conditions.** Wren, D.J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Apr 1983. 58p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702008.

Gas-phase reaction kinetics have been modelled for the release of cesium and iodine into steam and steam/hydrogen atmospheres. The conditions are those anticipated in a CANDU reactor fuel channel following some postulated loss-of-coolant accidents. A total of seventeen chemical species were used in the model, including all important cesium and iodine species. Reaction rate constants were taken from the literature, or calculated where possible, or estimated. The composition evolution of the system was calculated, following a burst release of cesium and iodine, as a function of total iodine and cesium concentrations, cesium/iodine release ratio, iodine release form (atomic I or CsI), fuel channel atmosphere, and radiolysis effects. In general, the calculation demonstrates that CsI and CsOH rapidly ($<10^{-2}$ s) become the most important species in the system for virtually all conditions. Atomic I is found to be significant only for very low release concentrations, or for Cs:I ratios less than unity. The main body of the modelling was performed at 1000 K. Some calculations were also performed for a three-node temperature system - 1500 K, 1000 K and 750 K - with the fission products being transported from high to low temperature. Thus, a qualitative picture is provided of the evolution of the chemistry in the fuel channel as the fission products are swept out by the residual steam flow.

44245 **(AECL—7908) Detailed neutron activation measurements in lattices with 31-element PuOsub(2)-UOsub(2) clusters of simulated burned-up natural uranium fuel in heavy water moderator.** French, P.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1983. 103p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701991.

Low power experiments have been performed in the ZED-2 reactor to determine detailed neutron activation distributions in the central cell of lattices containing 31-element clusters of PuOsub(2)-UOsub(2), simulated burned-up natural uranium oxide fuel in heavy water moderator. The measurements included Mn and Cu activity distributions, Lu/Mn and In/Mn activity ratios, and Pu/U fission rate ratios over a range of three lattice pitches with air, Hsub(2)O and HB-40 coolants. Relative total neutron densities, and the Westcott spectral parameters r√Tsub(n)/Tsub(o) and Tn were inferred from the experimental results. The results indicate that the neutron density gradient across a lattice cell is larger for Hsub(2)O and HB-40 coolants, and increases with increasing Pu-239 enrichment. The spectral parameters increase (harden) with decreasing pitch and coolant moderator power (Hsub(2)O yields HB-40 yields Air), and with increasing Pu-239 content, as expected.

44246 **(AECL—7918) Experiments performed in ZED-2 in support of the irradiation of $(Th,Pu)O_2$ fuel (BDL-422) in NRU.** Jones, R.T. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1984. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701992.

An NRU loop containing five 36-element bundles of $(Th,Pu)O_2$ fuel with 1.4 weight percent fissile content has been simulated in ZED-2. Measurements made included: (a) reactivity worth of the loop and its H_2O coolant, (b) flux perturbations caused by the loop, and (c) detailed reaction rates within and about the loop fuel including an investigation of end flux peaking caused by the inter-bundle gaps.

44247 **(AECL—8186) Mechanical development for reliable reactor components.** Ross-Ross, P.A.; Metcalfe, R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1983. 18p. (CONF-8004248—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702009.

From Canadian Society of Mechanical Engineers council and general meeting; Calgary, Alberta, Canada (1 Apr 1980).

The CANDU reactor has achieved worldwide distinction because of its reliable performance. To achieve this, special attention was given to the reliability and maintainability of components in the heavy water circuits. Development programs were initiated early in the history of the CANDU reactor to improve the effectiveness of pump seals, valves, and static seals because of unacceptable performance of the commercial equipment then available. As a result, pump seals with a five year life now appear achievable, and valves and static seals are no longer a significant concern in CANDU reactors. Increasing effort is being given remotely operated tools and fabrication systems for radioactive environments.

44248 **(AECL—8326) Thorium fuel cycles in CANDU reactors. A review.** Milgram, M.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702010.

Also published in Energy Newsletter vol. 4(3) Oct 1983.

The characteristics of various advanced fuel cycles possible in CANDU reactors are compared.

44249 **(AECL—8333(F)) CANDU lectures. Reactor core and fuel management.** Rouben, B. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. CANDU Operations). Jun 1984. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85702011.

This document is a compilation of notes prepared for two lectures given by the author in the winter of 1983 at the Institut de Genie Nucleaire, Ecole Polytechnique, Montreal. The first lecture gives a physical description of the CANDU reactor core: the nuclear lattice, the reactivity mechanisms, their functions and properties. This lecture also covers various aspects of reactor core physics and describes different calculational methods available. The second lecture studies the numerous facets of fuel management in CANDU reactors. The important variables in fuel management, and the rules guiding the refuelling strategy, are presented and illustrated by means of results obtained for the CANDU 600.

44250 **(OH—83-319-K) Estimating the number of latent cracks in pressure tube joints at Bruce unit 2.** Schwarz, C.J. (Ontario Hydro Research Lab., Toronto (Canada)). Oct 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702015.

A model was built to estimate the number of hydride cracks which might have arisen in the rolled joints of Bruce unit 2 prior to the stress relieving operation. The model estimated that about 100 such cracks might exist. Since this estimate is based on experiments that were thermally cycled and since cycling did not occur in Bruce, prior to stress relieving the actual number is expected to be substantially lower. A sensitivity analysis of the model showed that it is sensitive to the assumptions of stress levels, probability of initiation and distribution of initiation time. A better estimate could be made if more data were available on these parameters under realis-

tic conditions. Therefore, the recommendation is made to collect more information about these factors under realistic conditions.

44251 (OH—83-457-K) Final report on development evaluation of Task Group 3 pressure tubes. Fleck, R.G.; Price, E.G.; Cheadle, B.A. (Ontario Hydro Research Lab., Toronto (Canada)). Nov 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701944.

This report describes the production and evaluation of pressure tubes manufactured to the recommendations of Task Group 3 (TG3) of the Creep Engineering Design Plan. The Zr-2.5 wt percent Nb tubes were manufactured by modified production route to change their metallurgical structure and so reduce the in-service elongation rates. Three modified routes were investigated and a total of twenty-eight tubes produced. There were no difficulties in manufacture and the tubes satisfied the quality assurance and design specifications of reactor grade tubes. Metallurgical evaluation showed that the expected changes in microstructure had occurred but not to the extent anticipated. The TG3 tubes were found to have comparable properties to current tubes when tested for: tensile strength (irradiated and unirradiated); hydride cracking; stress to reorient hydrides; hydrogen diffusion; flaw tolerance; corrosion (irradiated and unirradiated); wear; rolled joint characteristics; irradiation creep and growth. Lower in-service elongation rates are expected for tubes produced by two of the modified routes.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 43816, 43819, 44285, 44341, 44361, 44362, 44366, 44612, 44615, 44626, 44628, 44632, 45914

44252 (CONF-850713—4) CREDO analysis: a comparison of liquid metal and water valve reliabilities. Painter, S.L.; Knee, H.E.; Humphrys, B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016355.

From International conference on nuclear power plant aging, availability factor and reliability analysis; San Diego, CA, USA (3 Jul 1985).

In this paper, data from the Centralized Reliability Data Organization (CREDO) are used to calculate failure rates and unscheduled maintenance frequencies for liquid metal valves. These failure rates and unscheduled maintenance frequencies are then compared to those calculated for valves from light water reactors. The liquid metal valves showed, in general, failure rates and unscheduled maintenance frequencies that are significantly lower than those of water valves (sometimes as much as an order of magnitude). Two possible reasons for the trend of lower failure rates and maintenance frequencies for liquid metal valves are then discussed.

44253 (CONF-850713—7) Review of effects of long-term aging on the mechanical properties and microstructures of Types 304 and 316 stainless steel. Horak, J.A.; Sikka, V.K.; Raske, D.T. (Oak Ridge National Lab., TN (USA); Argonne National Lab., IL (USA)). 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016472.

From International conference on nuclear power plant aging, availability factor and reliability analysis; San Diego, CA, USA (3 Jul 1985).

Because commercial liquid metal fast breeder reactor (LMFBR) are designed to last for 40 years or more, an understanding of the mechanical behavior of the structural alloys used in them is required for times on the order of 2.5×10^5 h (assuming a 70% availability factor). Types 304 and 316 stainless steel are used extensively in LMFBR systems. At the beginning of life these alloys are in a metastable state and evolve to a more stable state and, therefore, more stable microstructure during plant operation. Correlations of microstructures and mechanical properties during aging under representative LMFBR temperature and loading conditions are desirable from the standpoint of assuring safe, reliable, and economic plant operation. We reviewed the mechanical properties and microstructures of types 304 and 316 stainless steel wrought alloys after long-term aging in air for times up to 9×10^4 h (about 10-1/2 years). The principal effect of such aging is to reduce low temperature fracture toughness (as measured by Charpy impact test) and tensile ductility. Examples are cited, however, where, because stable microstructures are achieved, these as well as strength-related properties can be expected to remain adequate for anticipated service life conditions. 16 refs., 19 figs.

44254 (CONF-850903—6) Real-time LMFBR steam generator analyzer. Tzanos, C.P. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009708.

From International topical meeting on computer applications for nuclear power plant operation and control; Pasco, WA, USA (8 Sep 1985).

A model was developed for steam generator analysis in real-time. This model is based on a movable boundary formulation, the Gear method for the solution of stiff differential equations, and the use of analytic relationships. (DLC)

44255 (CONF-850926—2) Avoiding leakage flow-induced vibration by a tube-in-tube slip joint. Mulcahy, T.M. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006228.

From ASME vibration and sound conference; Cincinnati, OH, USA (10 Sep 1985).

Parameters and operating conditions (a stability map) were determined for which a specific slip-joint design did not cause self-excited lateral vibration of the two cantilevered, telescoping tubes forming the joint. The joint design featured a localized annular constriction. Flowrate, modal damping, tube engagement length, and eccentric positioning were among the parameters tested. Interestingly, all self-excited vibrations could be avoided by following a simple design rule: place constrictions only at the downstream end of the annular region between the tubes. Also, overall modal damping decreased with increased flowrate, at least initially, for upstream constrictions while the damping increased for downstream constrictions.

44256 (CONF-851007—2) Conceptual design basis and temperature predictions in a simulated instrumented LMFBR blanket subassembly. Betten, P.R.; Singer, R.M.; Lee, M.J.; Feldman, E.E.; Chang, L.K.; Mohr, D.; Planchon, H.P. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005051.

From 3. international meeting on reactor thermal hydraulics; Newport, RI, USA (15 Oct 1985).

The purpose of this paper is to: (1) present the conceptual design basis for an unfueled simulated LMFBR blanket subassembly, and (2) compare the predicted steady-state coolant temperatures for this subassembly with the measured coolant temperatures. This subassembly was designated as XX10 and was irradiated in the Experimental Breeder Reactor-II (EBR-II) during reactor run 129 at essentially full power and flow conditions. Because in-core data on LMFBR subassemblies are scarce, it is hoped that these data will further verify computer-codes and reduce uncertainties in the thermal-hydraulic design and analysis of LMFBR subassemblies. 2 refs., 1 fig.

44257 (CONF-8509122—1) Numerical simulation of heat exchanger. Sha, W.T. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015002.

From U.S.-Japan heat transfer joint seminar; San Diego, CA, USA (17 Sep 1985).

Accurate and detailed knowledge of the fluid flow field and thermal distribution inside a heat exchanger becomes invaluable as a large, efficient, and reliable unit is sought. This information is needed to provide proper evaluation of the thermal and structural performance characteristics of a heat exchanger. It is to be noted that an analytical prediction method, when properly validated, will greatly reduce the need for model testing, facilitate interpolating and extrapolating test data, aid in optimizing heat-exchanger design and performance, and provide scaling capability. Thus tremendous savings of cost and time are realized. With the advent of large digital computers and advances in the development of computational fluid mechanics, it has become possible to predict analytically,

through numerical solution, the conservation equations of mass, momentum, and energy for both the shellside and tubeside fluids. The numerical modeling technique will be a valuable, cost-effective design tool for development of advanced heat exchangers.

44258 **(CTA-IEAV-NT—08/84) Preliminary study of the thermo-hydraulic behaviour of the binary breeder reactor.** Silveira Luz, M. da; Ferreira, W.J. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Jun 1984. 26p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702016.

Continuing the development of the Binary Breeder Reactor, its physical configuration and the advantages of different types of spacers are analysed. In order to simulate the thermo-hydraulic behaviour and obtain data for a preliminary evaluation of the core geometry, the COBRA III C code was used to study the effects of the length and diameter of the fuel element, the coolant inlet temperature, the system pressure, helicoidal pitch and the pitch to diameter ratio.

44259 **(HEDL—SA-3237) Silicon compound formation in liquid sodium.** Yunker, W.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Mar 1985. Contract AC06-76FF02170. 19p. (CONF-850417—24). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013748.

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

The stability and relative rates of formation of a compound of silicon and sodium were measured in situ (529°C to 615°C in flowing sodium) utilizing the high sensitivity of hydraulic friction factor to the growth of the crystals in an instrumented flow section. Though the compound's instability outside of sodium has inhibited its identification, the preliminary results of its study are described. A strong dependence of crystal growth rate on system oxygen content was observed, though scanning auger microprobe examination of the crystals revealed only trace contamination by oxygen. X-ray diffraction patterns were not reproducible. Electrochemical titrations of silicon and oxygen in sodium with an indium/indium oxide electrode showed no change in compound formation in the O/Si range of 0.7 to 2.1. The cell temperature coefficient was 0.48 mV/K at 450°C to 530°C.

44260 (IWGFR—49-Vol.2, pp 517) **1 x 2M steel performance in the BOR-60 steam generator.** Golovanov, V.N.; Shamouzdin, V.K.; Kondratiev, V.I.; Kryukov, F.N.; Chernobrovkin, Yu.V.; Bulanova, T.M.; Bai, V.F. 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Abstract only.

44261 (IWGFR—49-Vol.2, pp 939-962) **Mechanical properties at high rates of strain of austenitic stainless steels in virgin and damaged conditions. Results and testing programme for containment of extreme dynamic loading conditions.** Albertini, C.; Montagnani, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The results of a test programme of dynamic tensile tests performed on small specimen (7 mm^2 cross section) of some austenitic stainless steels used for fast breeder reactor structures, are reported here. The results obtained on AISI 316 H at temperatures up to 550 deg. C and at strain rates up to $10^3 s^{-1}$ (JRC reference material) were used for the calibration of the constitutive equation proposed by Perzyna. In order to take into account the effects of increasing thickness, of a distribution of defects similar to that of the real structure, of the mismatch of material properties created by welding, and of macro defects which could appear near nozzles, a special apparatus has been constructed for dynamic tests with large loads up to 5 MN. The current and future testing programmes presented in this paper will examine the existing yield criteria, flow rules, failure theories and allow the calibration of constitutive equations capable of describing the dynamic mechanical response of the materials. The high load apparatus could also play an important role for the reconstruction of real loading histories. Therefore this research programme tries to produce consistent knowledge in fields of major importance from the economic and safety points of view.

44262 (IWGFR—49-Vol.2, pp 1019-1033) **Evaluation method of creep and fatigue strength for FBR welded joints.** Endo Tadayoshi; Sakon Toshio (Strength of Materials Research Lab., Takasago Technical Inst., Mitsubishi Heavy Industries Ltd., Hyogo (Japan)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

In fast breeder reactors, more detailed design at elevated temperature is required than in conventional fossile fuel power plants. One of the most important experiences in conventional power plants is creep and low cycle fatigue cracking of welded joints of high temperature use. Therefore, more careful requirements will be necessary for welded joint properties for fast breeder reactors. It is necessary to develop more reliable welded joints considering the detailed requirements for breeder reactor use. The authors report some problems experienced in conventional plants, and then discuss the mechanism of fracture of welded joint specimens in laboratory testing. Elevated temperature properties required for more reliable welded joints is also discussed.

44263 (IWGFR—49-Vol.2, pp 1065-1076) **Japanese R and D programme on the crack propagation properties for the FBR structural safety analysis.** Kitagawa, Masaki (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)); Okabayashi, Kunio; Wada, Yuhsaku (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

During the last ten years in Japan, a cooperative research work between the PNC and the nuclear fabricators on the FBR materials has produced an extensive amount of high temperature material strength data, which has been reflected in the Japanese FBR design standard. During the last few years, the studies on the fracture mechanics approach to the demonstration of the structural integrity have been increased. The low cycle fatigue crack propagation study at FBR temperatures were also started. This report first briefly describes the fracture mechanics approach for the demonstration of structural integrity of the loop type FBR, and secondly describes the R and D program on the high temperature low cycle crack growth behaviour and its preliminary experimental results.

44264 (IWGFR—49-Vol.2, pp 681) **Corrosion of materials in sodium in BOR-60 reactor core.** Agapoba, M.P.; Anikinov, A.M.; Golovanov, V.N. 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Abstract only.

44265 (IWGFR—49-Vol.2, pp 1079-1101) **1 x 2M steel performance in the BOR-60 steam generator.** Golovanov, V.N.; Shamardin, V.K.; Kondratiev, V.I.; Kryukov, F.N.; Chernobrovkin, Yu.V.; Bulanova, T.M.; Bai, V.F. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The results from studies of 1 x 2M steel characteristics are presented. This steel was used as the material for the BOR-60 steam generator that had been in operation under the steam generating mode for 18,000 hs (35,000 hs in sodium). It was revealed that the pit corrosion depth on the water/steam side evaporative tube sur-

faces was about 0.25 μm and less and the total corrosion rate was less than 0.06 mm/y. The mechanical properties of the material were essentially similar both in the evaporator and superheater and met all the requirements imposed. Based on the analysis of data on the decarbonizaton depth in sodium and on the corrosion damage in water and steam it was concluded that 1 x 2M steel can be successfully used as the steam generator material at the operating temperatures up to 470 deg. C and has sufficiently longer service-life as compared to 18,000 hs.

44266 (IWGFR—49-Vol.2, pp 755-772) **Effect of neutron irradiation on tensile properties of SUS304 stainless steel at elevated temperature.** Nakazawa, T.; Ebata, M.; Yuhara, S. (Power Reactor and Nuclear Fuel Development Corp. (Japan)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

It is well known that mechanical properties of materials change under the influence of neutron irradiation. Since the reactor vessel and in-reactor structural materials of Fast Breeder Reactors are also subject to neutron irradiation at elevated temperature, to clarify their behaviours under neutron irradiation is one of the essential factors for evaluation of the safety of FBR. Then, it becomes important to perform the post-irradiation test on the domestic structural materials SUS304 (equivalent to type AISI 304 stainless steel) quantitatively, in order to evaluate the irradiation environmental effect and to reflect the results in the design standards. From the above standpoint, the post-irradiation tests such as tensile, creep, fatigue and creep-fatigue tests have been conducted in PNC (Power Reactor and Nuclear Fuel Development Corporation). In this paper, herein, are described the SUS304 post-irradiation tensile test results. 0.2% proof strength and ultimate tensile strength of SUS304 increase with the neutron fluence. However, they scarcely change until 1 x 10^{21}n/cm^2(E > 0.1Mev). Elongation and reduction of area of SUS304 decrease with the neutron fluence, but they do not largely change until 1 x 10^{21}n/cm^2(E > 0.1MeV). Decrease in elongation of SUS304 caused by neutron irradiation corresponds with increase in 0.2% proof strength caused by neutron irradiation.

44267 (IWGFR—49-Vol.2, pp 773-799) **Low dose irradiation effects on DIN 1.4948 mechanical properties.** Schaaf, B. van der; Vries, M.I. de (Netherlands Energy Research Foundation, Petten). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

For the SNR 300 the licensing authorities require the determination of the lower boundaries of post-irradiation mechanical properties for DIN 1.4948 parent metal and welded joints. It has been established that with decreasing strain rate the post-irradiation tensile ductility decreases. A transition strain rate has been observed, above which there is no effect of irradiation on ductility. The transition strain rate increases with increasing temperature. Coarse grained heats show lower ultimate tensile strength above 800 K than fine grained heats. There is no significant effect of irradiation on load controlled high cycle fatigue with frequencies of 1 Hz or higher. In low cycle fatigue numbers of cycles to failure decrease with decreasing frequency. Increasing the test temperature reduces the number of cycles to failure even more. The frequency effect is more evident at 823 K. Parent metal has a better fatigue resistance than welded joints in unirradiated and irradiated condition. Creep strength is reduced by irradiation due to loss of ductility. It is shown that with increasing grain size the rupture strength decreases. The ductility of welded joints after irradiation is low, in some cases as low as 0.5% creep strain. After irradiation, tensile, creep and fatigue fracture surfaces show many more intergranular features than in the equivalent unirradiated condition. The promotion of intergranular fracture by irradiation and the consequent degradation of low strain rate mechanical properties is explained by the presence of helium on grain boundaries. Several measures to increase the helium content threshold can be taken, such as grain refinement, homogeneous boron distribution and promotion of helium bubble initiation. In cases where helium embrittlement is encountered, life reduction factors on unirradiated material properties must be applied.

44268 (IWGFR—49-Vol.2, pp 801-815) **Influence of medium dose neutron irradiation (<=10^{22} NCM^{-2}) on design properties for elastic analysis of X6CRNI1811 for permanent structures of SNR 300.** Breitling, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Irradiation experiments on X6CrNi1811 - the structural material of Type 304 ss for SNR 300 - have shown that under conditions representative of the reactor vessel and inner components like grid plate, shield vessel and instrumentation plate, irradiation embrittlement will occur. The embrittlement is most pronounced at low strain rate loading. The influence of irradiation on the material data used for elastic analysis in the design of SNR 300 structural components is described. The irradiation factors introduced in designing against low cycle fatigue and long-time loading are derived. The assumption has been made that the irradiation effects for SNR 300 components correlate with the amount of helium formed (high temperature embrittlement) and the total neutron fluence for SNR 300 components. The factors do not apply for the higher irradiated core components.

44269 (IWGFR—49-Vol.2, pp 963-973) **Interrelationship between material strength and component design under elevated temperature for FBR.** Nakagawa, Y. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Structural design under elevated temperature for fast breeder reactor plants is very troublesome compared to that of lower temperature reactors. This difficulty can be mainly discussed from two different stand points. One is design and design code, another is material strength. Components in FBR are operated under creep regime and time dependent creep behaviour should be elevated properly. This means the number and combinations of design code and material strength are significantly large and makes these systems very complicated. Material selection is, in no words, not an easy job. This should be done by not only material development but also component design stand point. With valuable experience of construction and research on FBR, a lot of information on component design and material behaviour is available. And it is a time to choose the "best material" from the entire stand points of component construction.

44270 (KFK—3763) **Measurements of local temperature distributions in rod bundles with sodium flow.** Moeller, R.; Tschoeke, H.; Kolodziej, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1984. 178p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751881.

With 319 figs.

In an electrically heated 19-rod bundle (P/D = 1.30, W/R = 1.40) with sodium flow the three-dimensional temperature fields in the rod clads were measured. The main characteristics of the test section are three adjacent heater rods in the duct wall zone instrumented on four measuring planes and rotatable by 360° under full power conditions; furthermore spacer grids which are axially movable, and a system allowing to bow one heater rod over the last third of its heated length. The results of measurements of the azimuthal temperature variations of the rotatable rods are presented for different operating conditions (80 <= anti Pe <= 360, 45 <= q <= 90 W/cm^2), different spacer grid positions relative to the measuring planes and different bowing positions of one rod. For better understanding of the experimental results cross sections of the 19-rod bundle were prepared. It became evident, that a well-known bundle geometry is very important for the interpretation of the experimental results.

44271 (ORNL/LMR/SP—85/6) Liquid Metal Reactor Programs: safeguards and program assurance. Technical progress report, June 1985. Cooper, W.L. Jr. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85014819.

Information is presented concerning the management of the nuclear energy standards program; coordination of standards development, application, and maintanance; development of the performance assurance information program; and coordination of the quality assurance program.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

44272 (AECL—8107) Large-signal, dynamic simulation of the SLOWPOKE-3 nuclear heating reactor. Tseng, C.M.; Lepp, R.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1983. 10p. (CONF-830707—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702018.

From Summer computer simulation conference; Vancouver, Canada (11 Jul 1983).

A 2 MWt nuclear reactor, called SLOWPOKE-3, is being developed at the Chalk River Nuclear Laboratories (CRNL). This reactor, which is cooled by natural circulation, is designed to produce hot water for commercial space heating and perhaps generate some electricity in remote locations where the costs of alternate forms of energy are high. A large-signal, dynamic simulation of this reactor, without closed-loop control, was developed and implemented on a hybrid computer, using the basic equations of conservation of mass, energy and momentum. The natural circulation of downcomer flow in the pool was simulated using a special filter, capable of modelling various flow conditions. The simulation was then used to study the intermediate and long-term transient response of SLOWPOKE-3 to large disturbances, such as loss of heat sink, loss of regulation, daily load following, and overcooling of the reactor coolant. Results of the simulation show that none of these disturbances produce hazardous transients.

44273 (LA-UR—85-2648) Thermochemical correlation of material transport in an alkali metal heat pipe. Merrigan, M.A.; Feber, R.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-850808—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015744.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

The use of high-power heat pipes in space power systems requires a means of life prediction. The design lifetimes required make experimental determination of life impractical. Thermochemical modeling of heat pipe corrosive failure modes has been investigated as a means of making such prediction. Results have been applied to tests of molybdenum-lithium heat pipes operating from 1400 to 1500°K. A free energy minimization routine coupled to a hydrodynamic model of the operating heat pipe has been used to give local equilibrium values of reaction products as a function of operating time. The predicted reactions for critical regions of the heat pipe were compared with limited results of post-test examinations. Corrosive damage to the heat pipe wick structure was correlated with high oxygen and nitrogen activity in the evaporator region of the heat pipe.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 44350, 44358

44274 (BMI—1985-065) Investigations on the decommissioning of nuclear facilities. Goertz, R.; Bastek, H.; Doerge, W.; Kruschel, K.P. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Feb 1985. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751904.

The study discusses and evaluates safety and licensing related aspects associated with the decommissioning of nuclear power plants. Important decommissioning projects and experiences with relevance to decommissioning are analyzed. Recent developments in the field of decommissioning techniques with the potential of reducing the occupational dose to decommissioning workers are described and their range of application is discussed. The radiological consequences of the recycling of scrap metal arising during decommissioning are assessed. The results may be used to evaluate present licensing practices and may be useful for future licensing procedures. Finally the environmental impact of radionuclide release via air and water pathways associated with decommissioning activities is estimated.

44275 (NUREG—0304-Vol.10-No.2) Regulatory and technical reports (Abstract Index Journal). Second quarter, April-June 1985. Vol. 10, No. 2. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jul 1985. 86p. NTIS, PC A05/MF A01 - GPO. File Number TI85901869.

This compilation consists of bibliographic data and abstracts for the formal regulatory and technical reports issued by the US Nuclear Regulatory Commission (NRC) Staff and its contractors. This issue covers the period from April to June 1985.

44276 (NUREG—0748-Vol.5-No.6) Operating reactors licensing actions summary. Volume 5, No. 6. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Aug 1985. 357p. NTIS, PC A16/MF A01 - GPO. File Number TI85901970.

The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Resource Management. This summary report is published for internal NRC use in managing the Operating Reactors Licensing Actions Program. Its content will change based on NRC management informational requirements.

44277 (NUREG—0750-Vol.21-No.5) Nuclear Regulatory Commission issuances. Volume 21, No. 5. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). May 1985. 531p. NTIS, PC A23/MF A01 - GPO. File Number TI85902049.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

44278 (NUREG—0936-Vol.4-No.2) NRC Regulatory Agenda. Quarterly report, April-June 1985. Volume 4, No. 2. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Rules and Records). Jul 1985. 214p. NTIS, PC A10/MF A01 - GPO. File Number TI85902003.

The NRC Regulatory Agenda is a compilation of all rules on which the NRC has proposed or is considering action and all petitions for rulemaking which have been received by the Commission and are pending disposition by the Commission. The Regulatory Agenda is updated and issued each quarter. The Agendas for April and October are published in their entirety in the Federal Register while a notice of availability is published in the Federal Register for the January and July Agendas.

44279 (NUREG—0940-Vol.4-No.2) Enforcement actions: significant actions resolved. Quarterly progress report, April-June 1985. Volume 4, No. 2. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Jul 1985. 339p. NTIS, PC A15/MF A01 - GPO. File Number TI85902011.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (April-June 1985) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions and the licensees' responses.

44280 (NUREG—1141) Technical Specifications: Fermi-2 (Docket No. 50-341). Appendix A to License No. NPF-43. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jul 1985. 491p. NTIS, PC A21/MF A01 - GPO. File Number TI85901874.

Limiting conditions for operation and surveillance requirements are presented for reactor control systems; power distribution limits; instrumentation; reactor coolant system; emergency core cooling systems; containment systems; plant systems; electrical power systems; refueling operations; special test exceptions; radioactive effluents; and radiological environmental monitoring.

2108 Economics

REFER ALSO TO CITATION(S) 44231

2109 Process Heat Reactors

44281 (Juel—1961) Conception of a modular HTR-process heat facility with optimization of the pressure level. Bousack, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Nov 1984. 191p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751883.

The operation of a steam reformer heated by nuclear power with a process pressure of about 20 bar provides advantages with respect to process engineering due to the improved conversion and simplified product gas treatment for the follow-on process. The effects of a reduction in pressure on the components of the primary circuit in a modular HTR facility, as well as various process engineering possibilities for producing methanol in the follow-on process are discussed in this paper. Studies cover the influence of core geometry and power density, as well as possibilities of increasing the modular power at a maximum accident temperature of 1600°C. An inherently functioning area cooling system is proposed for afterheat removal outside the primary circuit. Based on the optimized pressure, a modular HTR process heat facility is conceived to produce methanol from natural gas and carbon dioxide basically satisfying the requirement of zero emission.

22 NUCLEAR REACTOR TECHNOLOGY

44282 (NE—07-85-Master-Index) Nuclear standards master index. (Oak Ridge National Lab., TN (USA)). 24 Jul 1985. Contract AC05-84OR21400. 58p. Performance Assurance Project Office, ORNL, Box Y, Bldg. 9204-1, M/S 110, Rm. 321, Oak Ridge, TN. File Number TI85015114.

This index provides a complete list, organized by standard numbers, of all assigned NE numbers, their title, issue date, amendment number and date, issue date of the superseded standard if any, standards writer/cognizant engineer, DOE/cognizant engineer, and a remarks column which reflects the current status of the standard.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 45570, 45571, 45670, 45673, 45701

44283 (CEA-N—2398) Space and energy dependence of uranium 238 resonance capture rate in a heterogeneous lattice. Tellier, H.; Gonnord, J.; Van der Gucht, C.; Vanuxeem, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1984. 35p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751200.

Exact calculation of the uranium 238 resonance capture rate in a heterogeneous lattice is an important problem for reactor physics. This computation can be done by solving the slowing down equation in the multigroup approximation with a very detailed energy mesh for the cross sections representations. We also can use the Monte Carlo method. Both methods are very expensive. For this reason, less expensive procedures have to be used for design calculations. These last methods have to give the integrated reaction rate with a very good accuracy. In this work we have done a detailed comparison between the exact methods and the routine methods in the case of light water reactor and graphite reactor. In addition we give the variation of the self shielding factor with space and energy for a typical light water cell.

44284 (IPEN-Inf—17) Modification in the CITATION computer code: change of microscopic cross section by zone. Yamaguchi, Mitsuo; Kosaka, N. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1983. 15p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702041.

The modifications done in the CITATION computer code in order to compute the accumulated burnup after each burnup step for each reactor zone and to allow the use of update microscopic cross sections for each zone according to the accumulated burnup are presented. Some input data was introduced in the code. The modifications reported here were checked and some comparisons were made with results obtained by running the code with and without these modifications.

44285 (KFK—3838) Status of the nuclear data library KEDAK-4 - October 1984. Goel, B.; Krieg, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Feb 1985. 61p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85751906.

This document summarizes the status and the contents of the lately revised version of KEDAK. This report supersedes the previous reports KfK 2234 and 2386/I.

44286 Modeling cesium behavior in nuclear reactor fuels at high temperatures. Schumacher, G.; Wright, S.A. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Nuclear Materials;* **130**: 21-35(Feb 1985). (CONF-840807—; CONF-840808—). Contract AC04-76DP00789.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

Cesium has important influences on the steady state and transient behavior of nuclear reactor fuel because of its large fission yield and high volatility. Recent experiments show that the release of cesium coincides with the disruptive behavior of rapidly heated fuel. This report investigates the pressure buildup of cesium in fuel pores during fast power transients. A model was developed which estimates the pressure of cesium in the pores as a function of temperature and oxygen/metal ratio of the fuel. The results of the calculation with this model show that cesium has a higher potential for pressure buildup, at temperatures near the fuel melting point, than xenon. There are, however, open questions which concern the kinetics of the cesium release to the pores, the chemical stability of the cesium compounds, and the microscopic distribution of the cesium.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 44339, 44437, 44898

44287 (AECL—7799) Ballooning of thin-walled tubes with an azimuthal temperature gradient. Shewfelt, R.S.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701995.

The analysis of the ballooning of thin-walled tubes with azimuthal temperature gradients is frequently simplified by assuming the cross section remains circular. To estimate the errors caused by this assumption, a two-dimensional model was developed to estimate the deviations from a circular cross section caused by an azimuthal temperature gradient. The deviations were found to be small for the azimuthal temperature distributions considered and, consequently, predictions made by assuming the cross section remains circular are adequate.

44288 (BMI—1984-059) Calculations for protection against time-dependent strain. Fatigue data from stress-strain controlled fatigue tests with compressive and tensile stress, or bending stress, on steels. 3rd technical report. Herter, K.H. (Bundesministerium des Innern, Bonn (Germany, F.R.); Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). Nov 1984. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752127.

The calculations for the design of nuclear power plant components in accordance with nuclear standards (ASME-BPVC III or KTA) are required to include fatigue analyses taking into account calculated primary plus secondary stress, plus stress maxima. The number of possible stress cycles can then be derived from the incipient cracking and fatigue data available in the codes and standards. The effects of temperature, surface quality, welding and size of specimens have been investigated. It was found that the nominal safety defined in the codes frequently is not attained in reality. The curves hitherto available in the ASME or KTA codes may still be taken as a basis when proper and accurate measurement of strains and stresses is assured and the correct influencing parameters are taken into account, but for psychological reasons it seems advisable to rely on new curves using Ssub(L) = 10 and S = 1.5.

44289 (CONF-840806—Vol.1, pp 127-142) **Analyses of charcoal filters used in monitoring radioactive iodines.** Langhorst, S.M. (Univ. of Missouri, Columbia). Mar 1985. NTIS, PC A99/MF A01. File Number DE85012484.

From 18. DOE nuclear airborne waste management and air cleaning conference; Baltimore, MD, USA (13 Aug 1984).

Monitoring gaseous effluents for radioactive iodine is often performed using small filters containing activated charcoal impregnated with TEDA. In sampling effluents, these filters experience an aging or weathering effect, much like that observed in large charcoal filter beds. Evaluation of the radioiodine monitoring procedure used at the University of Missouri Research Reactor has led to the development of several analysis techniques designed to estimate the filter collection efficiency, to measure amounts of stable halogens captured on the filter, and to investigate water collection and TEDA loss during the sampling period.

44290 (EPRI-NP—4069M) Growth and breakdown of passive films on metal surfaces. Macdonald, D.D.; Smialowska, S.; Cragnolino, G. (Ohio State Univ. Research Foundation, Columbus (USA)). May 1985. 35p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920820.

A model based on oxide defect theory is developed for the growth of passive films on metals in aqueous environments. Growth of the film occurs as the result of inward diffusion of oxide ions, while outward diffusion of cations results in their dissolution in the environment. The electric field in the passive film is assumed to be constant, limited by dielectric breakdown in the oxide. Rate laws derived from this theory are in good agreement with experimental film growth values. The breakdown of passivity by aggressive anions, such as chloride, is also treated. Values for the critical breakdown potential and induction time for pit initiation from the model are in good agreement with literature experimental data. Measured values of film growth on some Fe-Cu-Ni alloys by ellipsometry were used with the model to evaluate the electric fields in the films.

44291 (EPRI-NP—4172M) Radiation data for design and qualification of nuclear plant equipment. Final report. Bouquet, F.; Winslow, J. (Jet Propulsion Lab., Pasadena, CA (USA)). Aug 1985. 49p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920784.

This report presents data summarizing the responses to ionizing radiation by synthetic organic materials of interest to the designers of nuclear power equipment and to nuclear qualification engineers. Five categories of synthetic organic materials are treated: insulators elastomers, lubricants, adhesives, and coatings. An overview of radiation effects on these materials is presented, along with examples of appropriate mechanical and electrical properties. Graphical summaries of radiation effects in the five categories of organic materials are presented in terms of the lowest threshold dose to produce any property change and the dose to produce a 25% property change. Synergisms, dose rate effects, and sensitization effects are treated.

44292 (NUREG—1155-Vol.2) Research program plan: steam generators. Muscara, J.; Serpan, C.Z. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jul 1985. 15p. NTIS, PC A02/MF A01 - GPO. File Number TI85901967.

This document presents a plan for research in Steam Generators to be performed by the Materials Engineering Branch, MEBR, Division of Engineering Technology, (EDET), Office of Nuclear Regulatory Research. It is one of four plans describing the ongoing research in the corresponding areas of MEBR activity. In order to answer the questions posed, the Steam Generator Program has been organized with the three elements of non-destructive examination; mechanical integrity testing; and corrosion, cleaning and decontamination.

44293 (NUREG/CR—0524) Characteristics and performance experience of loose-part monitoring systems in US commercial power reactors. Kryter, R.C.; Ricker, C.W. (Oak Ridge National Lab., TN (USA)). Dec 1978. Contract AC05-84OR21400. 29p. (ORNL/NUREG/TM—254). NTIS, PC A03/MF A01 - GPO. File Number TI85015874.

The technical development status of loose-part monitoring systems (LPMSs) and their performance records to date in commercial light-water-cooled nuclear power stations was assessed. On-site personal interviews with both technical and managerial personnel were conducted, along with demonstrations of system hardware, both in the manufacturers' laboratories and during normal power station operation. In all, ten utilities (9 PWR plants and 1 BWR) and five LPMS manufacturers were interviewed. The end product of these studies was a body of information consisting of both objective fact and subjective opinion, resulting in an assessment of the present status of loose-part monitoring and informed speculation on future possibilities. A general hardware and functional description of the LPMSs typically employed in presently operating nuclear power stations is given in Sect. 2, while operating experience, including the problems most often experienced with LPMSs, is related in Sect. 3. Section 4 discusses the capabilities of LPMSs to provide diagnostic information subsequent to the detection of a loose part. State-of-the-art LPMSs are described in Sect. 5, with emphasis on some of the more important design considerations applicable to both future plants and those already in service. It is concluded that although loose-part monitoring can provide economic and safety benefits to the plant when performed with sufficiently sensitive, reliable, and well-calibrated equipment and guided by a carefully conceived program, both prevalent operating practices and current basic LPMS technology will have to be improved before these benefits can be fully realized.

44294 (NUREG/CR—1119) Piping inelastic fracture mechanics analysis. Chang, C.I.; Nakagaki, M.; Griffis, C.A.; Masumura, R.A. (Naval Research Lab., Washington, DC (USA)). 30 Jun 1980. Contract AI06-80FF37115. 90p. (NRL-Memo—4259). NTIS, PC A05/MF A01 - GPO. File Number TI85015778.

This report summarizes the rsults and conclusions of Task 1 and 2 of the study on "piping inelastic fracture mechanics analysis", Contract Number (NRC-03-79-116). In these tasks, available experimental data and the analytical methods for predicting rupture of LWR piping have been assembled and assessed. The analytical techniques investigated can be catalogued into three major groups: gross structural response analysis, semiempirical methods, and the J-controlled growth approach.

44295 (NUREG/CR—1499) Two finite element techniques for computing mode I stress intensity factors in two- or three-dimensional problems. Iskander, S.K. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1981. Contract AC05-84OT21400. 92p. (ORNL/NUREG/CSD/TM—14). NTIS, PC A05/MF A01 - GPO. File Number TI85015917.

Two finite element (FE) approaches were used to calculate opening mode I stress intensity factors (K/sub I/) in two- or three-dimensional (2-D and 3-D) problems for the Heavy-Section Steel

Technology (HSST) program. For problems that can be modeled in two dimensions, two techniques were used. One of these may be termed an "energy release rate" technique, and the other is based on the classical near-tip displacement and stress field equations. For three-dimensional problems, only the latter technique was used. In the energy release technique, K/sub I/ is calculated as the change in potential energy of the structure due to a small change in crack length. The potential energy is calculated by the FE method but without completely solving the system of linear equations for the displacements. Furthermore, the system of linear equations is only slightly perturbed by the change in crack length and, therefore, many computations need not be repeated for the second structure with the slight change in crack length. Implementation of these last two items has resulted in considerable savings in the calculation of K/sub I/ as compared to two complete FE analyses. These ideas are incorporated in the FMECH code. The accuracy of the methods has been checked by comparing the results of the two approaches with each other and with closed form solutions. It is estimated that the accuracy of the results is about +-5%.

44296 **(NUREG/CR—1806) Heavy-Section Steel Technology Program quarterly progress report, July-September 1980.** Whitman, G.D.; Bryan, R.H. (Oak Ridge National Lab., TN (USA)). Dec 1980. Contract AC05-84OR21400. 67p. (ORNL/NUREG/TM—419). NTIS, PC A04/MF A01 - GPO. File Number TI85015926.

The Heavy-Section Steel Technology (HSST) Program is an engineering research activity conducted by the Oak Ridge National Laboratory for the Nuclear Regulatory Commission. The program comprises studies related to all areas of the technology of materials fabricated into thick-section primary-coolant containment systems of light-water-cooled nuclear power reactors. The investigation focuses on the behavior and structural integrity of steel pressure vessels containing cracklike flaws. Current work is organized into five tasks: (1) program administration and procurement, (2) fracture mechanics analyses and investigations, (3) investigations of irradiated materials, (4) thermal shock investigations, and (5) pressure vessel investigations. A finite-element code for analyzing nozzle-corner cracks is operational. Crack propagation and damping studies are continuing. Two capsules of fracture specimens in the Fourth HSST Irradiation Series are being irradiated. Thermal shock test TSE-5A was conducted successfully. A procedure for producing a satisfactory low-upper-shelf seam in intermediate test vessel V-8A was developed, and facility planning for pressurized thermal shock tests was continued.

44297 **(NUREG/CR—1938) Reduction of structural degrees of freedom.** Miller, C.A. (Brookhaven National Lab., Upton, NY (USA)). Apr 1981. Contract AC02-76CH00016. 89p. (BNL-NUREG—51341). NTIS, PC A05/MF A01 - GPO $4.00. File Number TI85016013.

An assessment is made of the errors in large structural systems when both Guyan and Modified Guyan Reduction are used. Second, the economies that may be achieved by using these reduction methods as compared with obtaining complete solutions (i.e., no reduction) are investigated.

44298 **(NUREG/CR—2332) Time dependent unavailability of a continuously monitored component.** Ginzburg, T.; Dickey, J.M.; Hall, R.E. (Brookhaven National Lab., Upton, NY (USA)). Aug 1981. Contract AC02-76CH00016. 42p. (BNL-NUREG—51457). NTIS, PC A03/MF A01 - GPO. File Number TI85015997.

The equations which describe the time dependent unavailability of a monitored component are developed and solved. It is assumed that the component failure rate satisfies a Weibull distribution and that each repair requires the same amount of time. A repair may restore the component to a condition similar to its condition just before the failure or alternatively to the same condition as a new component. The solutions for the unavailability are presented used in the FRANTIC II code. The accuracy of approximate solutions has been checked.

44299 **(SAND—84-1487C) Techniques and results from the internal pressurization of a 1/8 scale steel containment model.** Koenig, L.N.; Lambert, L.D. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 14p. (CONF-850809—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006760.

From 8. international conference on structural mechanics in reactor technology; Brussels, Belgium (19 Aug 1985).

A 1/8 scale model of a steel containment building was tested to failure using nitrogen gas. An extensive data base of the models response was generated that can be used to qualify methods used to predict response of containments. The test techniques and data acquisition and control systems are described and the experimental results for key areas of the model are discussed.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 44333, 44334, 44335

44300 **(AECL—7789) Study of the effect of circumferential temperature variations on fuel-sheath strain in an inert atmosphere.** Ferner, J.; Rondeau, R.K.; Rosinger, H.E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jul 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85902164.

A failure model for Zircaloy-4 fuel sheaths has been developed and used to predict the effect of circumferential temperature variations (ΔT) on fuel-sheath strain behaviour in an inert atmosphere. In addition, experimental data were generated for fuel-sheath failures in the α and $(\alpha+\beta)$-phase regions and compared to the predictions of the model. For both the experimental data and the model predictions it was found that increasing ΔT decreases sheath strain. Most of the reduction in burst strain with increasing ΔT occurs in the first 15 K to 20 K. For high ΔT values, burst strains in the α- and $(\alpha+\beta)$-phase regions tend to an asymptotic value in the range 5 to 20 percent, irrespective of both heating rate and circumferential temperature variation. The BURST-2 computer code was used for these calculations.

44301 **(AECL—8069) Transient fission product release within operating UO_2 fuel elements during power cycles.** Lipsett, J.J.; Hunt, C.E.L.; Hastings, I.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 33p. (CONF-8305155—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702000.

From 4. specialists' meeting on water reactor fuel safety in off-normal and accident conditions; Roskilde, Denmark (16 May 1983).

We have measured short-lived fission product release during shutdown and startup transients for intact UO_2 fuel elements normally operating at linear powers of 45-62 kW/m. The magnitudes of the transient releases are dependent on the steady state operating power and severity of the transient. It is inferred that the inventory of short-lived species at the fuel-to-sheath gap, and thus the accident source term, could be augmented by a series of normal operation transients.

44302 **(AECL—8564) Release of short-lived fission products from operating UO_2 fuel under oxidizing conditions.** Hunt, C.E.L.; Lipsett, J.J.; Hastings, I.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1984. 16p. (CONF-840701—26). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702002.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

We have examined, using a sweep gas technique, the effects of oxidation on the release of short-lived fission products from UO_2 fuel elements which defected, and from intact elements where water was deliberately added via the sweep gas. In both types of experiment, the short-lived fission products showed qualitatively similar behaviour. On initiating oxidation, there was a transient period during which the release of fission products depended on their inventory in the UO_2. After the transient, diffusion-controlled steady state release resumed. Fission gases with short-lived precur-

sors were released at about twice the pre-transient rate while those with long-lived precursors (Xe-133, -135m, -135) were released at about 4.5 times the pre-transient rate. These results suggest that, under oxidizing conditions, the effective diffusion coefficient for the iodines increases more than that of the rare gases.

44303 (DOE/NE/34130—1-Vol.2, pp 4.69-4.86) **Fission gas releases during post irradiation annealing of UO_2 up to 1750°C.** Killeen, J.C.; Baker, C. (Berkeley Nuclear Labs., England). Apr 1985. NTIS (US Sales Only), PC A16/MF A01. File Number DE85011221. (CONF-850401—Vol.2).

From Topical meeting on light water reactor fuel performance; Orlando, FL, USA (21 Apr 1985).

One of the uncertainties in the analysis of possible reactor accidents is the behavior of gaseous fission products in fuel that is subject to transient overheating. In the present series of experiments thermal reactor fuel with a maximum burn-up of 11,000 MWd/TeU has been annealed out of pile at temperatures of up to 1750°C. Slow heating rates, ≦ 1°C/sec, have been used and continuous measurements of the oxygen potential of the sample atmosphere and of the ^{85}Kr release have been made. Both scanning and transmission electron microscopy have been carried out on the annealed samples. Under strongly reducing conditions, in an atmosphere of 2% hydrogen in argon, gas atom trapping within the grains is thought to inhibit release of fission gas temperatures below 1500°C such that the fractional release is dominated by a transient release on heating which is typically 0.1%. At higher temperatures, ≧ 1600°C, the release measured appears to be due to a diffusion mechanism within the grains while the intragranular, fission gas bubble population evolves. Two further features of these experiments are a transient release on cooling and a strong influence of the oxygen potential of the sample atmosphere on the release rate of ^{85}Kr.

44304 (KFK—3818) **Experimental investigations on the fluid flow through an asymmetric rod bundle (P/D = 1.148, W/D = 1.074).** Rehme, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1984. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751902.

Measurements of the distributions of the mean velocity, the wall shear stresses and the turbulence were performed in a wall subchannel of a rod bundle of four prallel rods arranged asymmetrically in a rectangular (P/D = 1.148, W/D = 1.074). The Reynolds number of this investigations was $Re = 7.89 \times 10^4$. The results obtained by a fully automated rig are compared with those from manual operation. The experimental results show that the momentum transport is highly anisotropic especially in the gaps of the rod bundle. Influences of secondary flow cannot be detected in the distribution of the time-mean velocity. The comparison between experimental wall shear stress distributions and those calculated with the VELASCO-code shows discrepancies both in the gap between the rod and channel walls and in the gap between the rods caused by the high momentum transport between the two subchannels.

44305 (NUREG/CR—1339) **Independent assessment of the steady state fuel rod analysis code FRAPCON-1.** Laats, E.T.; Peeler, G.B.; Scofield, N.R. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1980. Contract AC07-76ID01570. 116p. (EGG—2020). NTIS, PC A06/MF A01 - GPO. File Number TI85015858.

The predictive capabilities of the steady state fuel rod behavior program, FRAPCON-1, have been independently assessed. FRAPCON-1 code predictions of fuel behavior are compared with experimental data for test rods and with predictions from the FRAP-S3 code for commercial design rods. The code-to-data comparisons are used to assess the accuracy of fuel rod thermal, pressure, deformation, and corrosion models under steady state operating conditions. The code-to-code comparisons are used to identify the effects of model differences between FRAPCON-1 and the previously assessed fuel behavior code, FRAP-S3. On the basis of results of these studies, conclusions are given regarding present model capabilities and future development needs.

44306 (NUREG/CR—1917) **Validation of three cross-section libraries used with the SCALE system for criticality safety analysis.** Hathout, A.M.; Westfall, R.M.; Dodds, H.L. (Oak Ridge National Lab., TN (USA)). Jun 1981. Contract AC05-84OR21400. 36p. (ORNL/NUREG/CSD/TM—19). NTIS, PC A03/MF A01 - GPO. File Number TI85015983.

The calculations and analysis of two series of recently performed critical experiments are presented. Three cross-section libraries available in the SCALE system are used in the analyses. The results obtained are discussed in detail and are compared with MORET code calculations. The comparison with experimental results validates the cross-section libraries and allows an optimistic approach to the results of future studies using the three libraries and the SCALE system.

44307 (SKI-B—49-82) **Evaluation of uncertainties in MUF for a LWR fuel fabrication plant. Pt.2 - Pt.4.** Mennerdahl, D. (Swedish Nuclear Power Inspectorate, Stockholm). Sep 1984. 50p. (EMS-NP—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702003.

The ASEA-ATOM company has been participating in the project.

MUF (Material Unaccounted For) is a parameter defined as the estimated loss of materials during a certain period of time. A suitable method for uncertainty and bias estimations has been developed. The method was specifically adjusted for a facility like the ASEA-ATOM fuel fabrication plant. Operations that are expected to contribute to the uncertainties have been compiled. Information that is required for the application of the developed method is described. Proposals for simplification of the required information without losing the accuracy are suggested. ASEA-ATOM had earlier determined uncertainty data for the scales that are used for nuclear materials. The statistical uncertainties included random errors, short-term and long-term systematic errors. Information for the determination of biases was also determined (constants and formulas). The method proposed by ASEA-ATOM for the determination of uncertainties due to the scales is compatible with the method proposed in this report. For other operations than weighing, the information from ASEA-ATOM is limited. Such operations are completely dominating the total uncertainty in MUF. Examples of calculations of uncertainties and bias are given for uranium oxide powders in large containers. Examples emphasize the differences between various statistical errors (random and systematic errors) and biases (known errors). The importance of correlations between different items in the inventories is explained. A specific correlation of great importance is the use of nominal factors (uranium concentration). A portable personal computer can be used to determine uncertainties in MUF.

2204 Control Systems

44308 (AECL—8342) **Design of a multivariable controller for a CANDU 600 MWe nuclear power plant using the INA method.** Roy, N.; Boisvert; J.; Mensah, S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1984. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702014.

The development of large and complex nuclear and process plants requires high-performance control systems, designed with rigorous multivariable techniques. This work is part of an analytical study demonstrating the real potential of multivariable methods. It covers every step in the design of a multi-variable controller for a Gentilly-2 type CANDU 600 MWe nuclear power plant using the Inverse Nyquist Array (INA) method. First the linear design model and its preliminary modifications are described. The design tools are reviewed and the operations required to achieve open-loop diagonal dominance are thoroughly described. Analysis of the closed-loop system is then performed and a feedback matrix is selected to meet the design specifications. The performance of the controller on the linear model is verified by simulation. Finally, the controller is implemented on the reference non-linear model to assess its overall performance. The results show that the INA method can be used successfully to design controllers for large and complex systems.

44309 (AECL—8484) Reassessment of the control system of the NRX research reactor. Hinds, H.W.; Barker, C.J.; Graham, R.D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1984. 27p. (CONF-8404249—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702017.

From 10. annual symposium on simulation of reactor dynamics and plant control; Saint John, New Brunswick, Canada (9 Apr 1984).

The purpose of this work was to reassess the flux control system of the NRX research reactor at the Chalk River Nuclear Laboratories, in light of the various changes which have occurred since 1960. The major change was the conversion from natural to enriched fuel; the result was an increase in the incremental worth of the moderator by a factor of 2. As NRX uses moderator level to control neutron flux, this represents a large increase in system gain with potential destabilizing consequences. Two separate models of the reactor and its control system were developed, a linear, frequency-domain model giving Bode and Nyquist plots, and a nonlinear time-domain model implemented via the simulation package FORSIM. Two sets of tests were run on the reactor, namely, steady-state and dynamic tests of the control valve/hydraulic system with the reactor poisoned out, and step-response tests at full power and at various moderator heights.

44310 (CONF-850903—2) Combination of artificial intelligence and procedural language programs in a computer application system supporting nuclear reactor operations. Town, G.G.; Stratton, R.C. (Argonne National Lab., Idaho Falls, ID (USA); Central Washington Univ., Ellensburg (USA). Dept. of Computer Science). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02. File Number DE85007937.

From International topical meeting on computer applications for nuclear power plant operation and control; Pasco, WA, USA (8 Sep 1985).

A computer application system is described which provides nuclear reactor power plant operators with an improved decision support system. This system combines traditional computer applications such as graphics display with artificial intelligence methodologies such as reasoning and diagnosis so as to improve plant operability. This paper discusses the issues, and a solution, involved with the system integration of applications developed using traditional and artificial intelligence languages.

44311 (NUREG—1155-Vol.4) Research program plan. Non-destructive examination. Volume 4. Muscara, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jul 1985. 25p. NTIS, PC A02/MF A01 - GPO. File Number TI85901969.

Nondestructive examination/evaluation (NDE) of nuclear reactor components is required during fabrication, before service, and at regularly scheduled shutdowns for periodic inservice inspection (ISI). Any flaws produced during fabrication should be detected by the fabrication and preservice baseline examinations and components containing rejectable flaws should be repaired before the reactor enters service. The purpose of ISI is to ensure that any flaws which develop during service can be detected and evaluated and that unacceptable components are repaired or replaced to maintain safety, as well as to identify possible generic-type defects that may be present or developing in the remainder of the system or other similar systems so that timely corrective actions can be taken. The major thrusts of the research in ultrasonic testing for ISI are (1) to define the influence of inspection variables and procedures on inspection reliability and to determine the impact of inspection unreliability on system safety and (2) to study and evaluate improved techniques for reliable and accurate flaw detection and characterization. This research, therefore, has direct impact on evaluations of and improvements in reactor safety.

44312 (NUREG/CR—4227) Human engineering guidelines for the evaluation and assessment of Video Display Units. Gilmore, W.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1985. Contract AC07-76ID01570. 537p. (EGG—2388). NTIS, PC A23/MF A01 - GPO. File Number TI85016435.

This report provides the Nuclear Regulatory Commission with a single source that documents known guidelines for conducting formal Human Factors evaluations of Video Display Units (VDUs). The handbook is a "cookbook" of acceptance guidelines for the reviewer faced with the task of evaluating VDUs already designed or planned for service in the control room. The areas addressed are video displays, controls, control/display integration, and workplace layout. Guidelines relevant to each of those areas are presented. The existence of supporting research is also indicated for each guideline. A Comment section and Method for Assessment section are provided for each set of guidelines.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 44274, 45121

44313 (EGG-PBS—6896) Technical evaluation of RETS-required reports for Duane Arnold Energy Center Unit No. 1. Young, T.E.; Magleby, E.H.; Henscheid, J.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 12 Jun 1985. Contract AC07-76ID01570. 51p. NTIS, PC A04 - GPO. File Number DE85017487.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed were the Annual Radiological Environmental Operating Report for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 8 refs.

44314 (EGG-PBS—6938) Technical evaluation of RETS-required reports for Fort Calhoun Station Unit 1. Magleby, E.H.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 24 Jun 1985. Contract AC07-76ID01570. 53p. NTIS, PC A04/MF A01 - GPO. File Number TI85017498.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed for Fort Calhoun Station Unit 1 were two Semiannual Reports for Technical Specification 5.9.4. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 4 refs.

44315 (EGG-PBS—6952) Technical evaluation of RETS-required reports for the Point Beach Nuclear Plant, Units 1 and 2. Magleby, E.H.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 27 Jun 1985. Contract AC07-76ID01570. 50p. NTIS, PC A03/MF A01 - GPO. File Number TI85017459.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed for the Point Beach Nuclear Plant were the Annual Radiological Environmental Operating Report for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines.

44316 (EGG-PBS—6954) Technical evaluation of RETS-required reports for Joseph M. Farley Nuclear Plant, Units 1 and 2 for 1983. Young, T.E.; Magleby, E.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1 Jul 1985. Contract AC07-76ID01570. 65p. NTIS, PC A04/MF A01 - GPO. File Number TI85017469.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed for the Joseph M. Farley Nuclear Plant were the Annual Environmental Operating Report Part B: Radiological for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radioogical Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 6 refs.

44317 **(KFK—3778) Retention of ^{131}I volatilized from aqueous solutions by sorbents.** Deuber, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Feb 1985. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751907.

By far the largest proportion of the I-131 that was volatilized from alkaline aqueous solutions was in a form whose retention by various sorbents was lower than that of I_2, but higher than that of CH_3I. This form is called 'HOI' although no direct identification exists. With all the fresh impregnated activated carbons investigated, the retention of 'HOI' was higher than 99% at a residence time of 0.1 s. The influence of purging was insignificant.

44318 **(NUREG/CR—0750) Concentration and speciation of copper in waters collected near the San Onofre and Diablo Canyon Nuclear Power Stations.** Harrison, F.L.; Bishop, D.J.; Emerson, R.R.; Rice, D.W. Jr. (Lawrence Livermore National Lab., CA (USA)). Aug 1980. Contract W-7405-ENG-48. 76p. (UCRL—52706). NTIS, PC A05/MF A01 - GPO. File Number TI85015940.

Concentrations and physicochemical forms of copper were determined in seawater collected in the intake and discharge areas of the San Onofre and Diablo Canyon Nuclear Power Stations. At the San Onofre Station, which has half copper-nickel and half titanium tubing in its cooling system, the copper in the water column during normal operation ranged from 0.8 to 3.3 μg/L. At the Diablo Canyon Power Station, which has only titanium tubing in its cooling system (except for that in an auxiliary system), copper concentrations ranged from 0.6 to 2.3 μg/L. The San Onofre Station has a long operational history, whereas the Diablo Canyon Station has never generated electricity. Copper concentrations in effluent waters at San Onofre were usually higher than those in waters from control and intake areas, but differences were small. Copper in the particulate fraction of the discharge waters ranged from less than 10 to 75% of the total. Copper in the soluble fraction was primarily in bound forms. ^{64}Cu labeling indicated that less than 20% of the copper was in chemical forms available to biota. Copper complexation appears to involve organic matter of >1000 and $<100{,}000$ molecular weight range.

44319 **(NUREG/CR—2227) Radioactive materials released from nuclear power plants.** Tichler, J.; Benkovitz, C. (Brookhaven National Lab., Upton, NY (USA)). Nov 1981. Contract AC02-76CH00016. 190p. (BNL-NUREG—51416). NTIS, PC A09/MF A01 - GPO. File Number TI85015996.

Releases of radioactive materials in airborne and liquid effluents from commercial light water reactors during 1979 have been compiled and reported. Data on solid waste shipments as well as selected operating information have been included. This report supplements earlier annual reports issued by the former Atomic Energy Commission and the Nuclear Regulatory Commission. The 1979 release data are compared with previous year's releases in tabular form. Data covering specific radionuclides are summarized.

44320 (RRC—55, pp 20-32) **Community emergency planning.** Nagel, E. (Eidgenoessisches Institut fur Reaktorforschung, Wuerenlingen, Switzerland). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

In Switzerland, the emergency planning has been organized in such a way that an accident in a nuclear plant, the population that could be affected by releases, can be rapidly warned and alerted in order to be able to behave in accordance with procedures laid down by the authorities. A schedule has been developed for alerting communities situated in the neighborhood of nuclear power plants; but it is also effective in the vicinity of a research reactor plant. 10 figs. (DT)

44321 (RRC—55, pp 33-46) **National nuclear emergency planning in Japan.** Suzuki-Yasumoto, M. (National Institute of Radiological Sciences, Anagawa, Chiba, Japan). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The general policy of nuclear emergency preparedness planning in Japan is based giving priority to maintenance of safety in nuclear technology and radiation protection, and in minimizing exposures of workers and the public in the event of a major nuclear accident. Therefore, many actual provisions of nuclear emergency preparedness are, in a sense, in-depth protective measures. There are usually two phases of the national nuclear emergency planning. One is those for on-site emergency, and the other is those for off-site emergency. 2 tabs. (DT)

44322 (RRC—55, pp 115-129) **Assessment of potential releases.** Lister, B.A.J. (Atomic Energy Research Establishment, Harwell, Great Britain). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Estimation of the possible releases to atmosphere and their consequences is necessary for the establishment of an appropriate emergency organization. But for this purpose such estimates can be made using generalized models. 3 refs., 4 figs., 6 tabs. (DT)

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 44309

44323 **(CONF-850871—3-Draft) National facility for small-angle neutron scattering: five years' operating experience. Draft.** Koehler, W.C.; Bunick, G.J.; Child, H.R.; Hayter, J.B.; Lin, J.S.; Maddox, L.; Spooner, S.; Wignall, G.D. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016298.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

At the time of this Conference on Neutron Scattering, the ORNL-NSF-DOE National Facility for Small-Angle Neutron Scattering will have been operating routinely in a full-time user mode for nearly five years. The Facility, located at the High Flux Isotope Reactor at ORNL, is part of the National Center for Small-Angle Scattering Research. Operating experience and scientific highlights for the past five years are surveyed.

44324 **(EGG/LTR—20-73) Condition I through IV faults during blowdown.** Crump, R.J.; Cooper, C.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 26 Jan 1979. Contract AC07-76ID01570. 10p. (EGG-RE-A—77-002). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015850.

This report presents the results of a qualitative analysis to classify potential fault conditions that may occur during a loss of coolant experiment (LOCE). In addition, recommended calculations are provided to assure that identified conditions meet the assigned damage criteria which are defined in Section 3.13 of the LOFT Technical Specification. The analysis was based upon a nuclear core being installed and generating heat; therefore, LOFT is operating in test series L2.

44325 (EGG/LTR—112-110-Suppl.1) Simplified elastic-plastic analysis of Flange No. 7, LOFT Blowdown System. Supplement 1. Chun, R.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 12 Jul 1978. Contract AC07-76ID01570. 7p. (RE-E—77-124-Suppl.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015449.

Stress analysis results are presented for Flange # 7 of the LOFT blowdown system. (DCC)

44326 (EGG/LTR—126-8) Calculation of membrane penetration M-14 air flow capacity. Eidam, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 22 Mar 1979. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015433.

This document contains a study which determined whether the air flow through the 8-inch vent in the membrane penetration M-14 was sufficient to keep the ΔP between the test chamber and basement below 2.08 psi when the test chamber was vented to atmosphere through a 3-inch line. The study revealed the differential can never approach the assumed value of 2.0 psi.

44327 (EUR—9037) 1983 Annual status report. Operation of the high flux reactor. (Commission of the European Communities, Luxembourg). 1984. 27p. Commission of the European Communities, Luxembourg.

The high flux materials testing reactor has been operated in 1983 within a few percent of the pre-set schedule. A major out-age period began as planned on 28 November 1983 for the replacement of the present reactor vessel and its peripheral equipment. During the ten operating cycles before shut-down the reactor utilization reached another record figure in 22 years at 84% of the theoretical full load.

44328 (IPEN-Inf—16) Neutron radiography on the research reactor IEA-R1. Fuga, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1984. 24p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701988.

The neutron radiography device is composed of a conical neutron collimator, having a 1/250 collimation ratio, an object chamber and an irradiation cassete. Each component on the system is described and some representative results are presented. Selected examples of the potentialities of this technique are given.

44329 (NUREG/CR—1382) Summary report of fuel rod displacement sensor for LOFT. Billeter, T.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1980. Contract AC06-76FF02170. 51p. (HEDL-TME—80-17). NTIS, PC A04/MF A01 - GPO. File Number TI85015876.

Qualification tests and operational characteristics of a displacement sensor are described. As a transducer to be used for measurement of axial motion of fuel rods in the LOFT reactor during a blowdown transient, the test environment included temperatures to 800°F and 2500 psig applied pressure. In addition, the transducer withstood transient tests in an autoclave and in a quench bath. All of the three units tested survived the rigorous test sequence of about 700 hours duration.

44330 (NUREG/CR—1710-Vol.2) Computerized process control system for the ORR-PSF irradiation experiment. Part 2: mathematical basis and computer implementation of the temperature control algorithm. Volume 2. Miller, L.F. (Oak Ridge National Lab., TN (USA)). Nov 1980. Contract AC05-84OR21400. 71p. (ORNL/NUREG/TM—405/P2). NTIS, PC A04/MF A01 - GPO. File Number TI85015879.

A brief description of the Oak Ridge Reactor Pool Side Facility (ORR-PSF) and of the associated control system is given. The ORR-PSF capsule temperatures are controlled by a digital computer which regulates the percent power delivered to electrical heaters. The total electrical power which can be input to a particular heater is determined by the setting of an associated variac. This report concentrates on the description of the ORR-PSF irradiation experiment computer control algorithm. The algorithm is an implementation of a discrete-time, state variable, optimal control approach. The Riccati equation is solved for a discretized system model to determine the control law. Experiments performed to obtain system model parameters are described. Results of performance evaluation experiments are also presented. The control algorithm maintains both capsule temperatures within a 288°C +-10°C band as required. The pressure vessel capsule temperatures are effectively maintained within a 288°C +-5°C band.

44331 (ORNL/TM—9551) Bulk Shielding Facility quarterly report, October, November and December 1984. Corbett, B.L.; Lance, E.D.; Muggridge, F.E. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015056.

The BSR operated at an average power level of 920 kW for 0.5% of the time during October, November, and December. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The PCA was not used during the quarter.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 44244, 44311, 44640, 45130, 45299

44332 (AECL—7550) Probabilistic assessment and design of overpower trips in CANDU reactors. Bailey, C.M.; Laratta, F.A.R. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. CANDU Operations). 1983. 17p. (CONF-831047—143). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702007.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The data used for the design and operation of the Neutron Overpower (NOP) trip systems in CANDU reactors are subject to errors and uncertainty in their values, for which a suitable allowance must be made. The final NOP setpoints thus depend on the size of this error allowance in relation to the magnitudes of the various types of errors expected. This report outlines a new probabilistic assessment procedure for determining the NOP error allowance needed to meet a specified level of confidence. The procedure is relatively simple and computationally inexpensive, yet provides a comprehensive and reasonably rigorous assessment of the statistical risk of the NOP errors. Margins of about 11 percent have been found sufficient to meet regulatory requirements with the new procedure, compared with 18 to 20 percent previously. A further extension of the procedure, to probabilistic optimization of the core reference power shape, is also outlined.

44333 (AECL—7751) Purposely defected UO_2-Zircaloy fuel elements irradiated in pressurized light water at linear powers of 55 kW/m. MacDonald, R.D.; Lipsett, J.J.; Perez, E.E.; Kos, P.K. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 70p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701998.

The FDO-87 experiment consisted of three separate irradiation tests of purposely defected Zircaloy clad UO_2 fuel elements. The elements were irradiated at linear heat outputs between 53 and 58 kW/m for in-reactor times up to 950 hours. The fission products released from the defected elements into the hot pressurized water coolant were continuously monitored by an on-line γ-ray spectrometer. Steady state fission product release rates were established as functions of irradiation time, the decay constant (lambda), hole size and shape, and fuel burnup. Transient releases were measured for trip and controlled reactor shutdowns, reactor startups and power cycles.

44334 (AECL—7791) Effect of oxygen on the failure of reactor fuel sheaths during a postulated loss-of-coolant accident. Ferner, J.; Rosinger, H.E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701999.

The failure model for Zircaloy-4 reactor fuel sheaths was used to study the effect of steam oxidation on sheath burst strain.

The model, in the form of a computer program called BURST-3, was used to calculate burst strain for a Zircaloy-4 sheath under arbitrary pressure and temperature sequences in an oxidizing (steam) atmosphere. In particular, BURST-3 was used in a parametric study to predict the sheath behaviour in steam as compared to an inert atmosphere, the effect of heating rate, and the effect of circumferential temperature variations on burst strain. It was found that fuel sheath oxidation, which decreases burst strain, becomes increasingly important with increasing temperature and/or time. An effective oxygen concentration of greater than 0.27 wt. percent will cause the sheath to fail with a negligible strain. The hottest region of a sheath will have the highest oxygen concentration, the largest localized strain, and will be the site of failure. The model predictions were compared to experimental data in the range 900 to 1600 K. Agreement between theory and experiment for all three heating rates (5, 25, and 100 $K.s^{-1}$) was very good.

44335 **(AECL—8104) Investigations of crack initiation during environmentally induced cracking of the Zircaloys.** Haddad, R.; Cox, B. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702001.

Investigation of the crack initiation stage in Zircaloy fuel cladding has shown that diffusion of an aggressive species ahead of the crack tip during the incubation time, to form an 'active path' which subsequently cracks rapidly, cannot be occurring. The appearance of such a situation arises in these experiments not because the incubation time is a feature of the cracking mechanism but because the specimen is not at thermal and chemical equilibrium with the environment at the start of the test. When efforts are taken to bring the specimen to such equilibria rapidly before stressing, the incubation time decreases to near zero and cracking in I_2 or Cs/Cd starts almost immediately. No second phase particles or concentration of alloying elements are needed at the crack initiation site under such conditions, and crack initiation and propagation processes appear to be identical and predominantly transgranular. Organic halide contamination (e.g. methyl iodide) of the iodine results in a more aggressive environment than iodine alone, and is accompanied by characteristic fractographic features not usually otherwise seen. Such features have not been seen in PCI cracks, but only relatively small areas of such cracks have yet been examined.

44336 **(AECL—8265) Dynamic response degradation of platinum self-powered detectors with low insulation resistance.** Drewell, N.H.; Delcol, K. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1984. 21p. (CONF-8310339—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702004.

From NEACRP specialist meeting on in-core instrumentation and the assessment of reactor nuclear and thermal hydraulic performances; Halden, Norway (10 Oct 1983).

Self-powered flux detectors used in the control and safety systems in CANDU reactors must respond promptly to changes in neutron flux. Recent tests showed that a detector can fail in a manner that impairs its speed of response without affecting its DC sensitivity. Follow-up experiments were conducted to investigate the phenomenon further. Preliminary results and conclusions are presented and methods of identifying such failures are discussed.

44337 **(AECL—8335) Analysis of the pressure tube failure at Pickering NGS 'A' unit 2.** Field, G.J.; Dunn, J.T.; Cheadle, B.A. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. CANDU Operations). Jun 1984. 12p. (CONF-840613—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702012.

From 24. annual international conference of the Canadian Nuclear Association and the 5. annual conference of the Canadian Nuclear Society; Saskatoon, Saskatchewan, Canada (3 Jun 1984).

The failure of a Zircaloy-2 pressure tube in Pickering unit 2 in August 1983 has been found to have been caused by an accelerated pickup rate of deuterium, contact between the pressure tube and its surrounding calandria tube, and rapid growth of zirconium hydride blisters. The pressure tubes in all later CANDU reactors are made from a zirconium-niobium alloy. Examination of several Zircaloy-2 and zirconium-niobium pressure tubes from different reactors has clearly shown that the deuterium pickup rate of the two materials is significantly different. The zirconium-niobium pressure tubes have absorbed very little deuterium and they do not appear to be susceptible to the type of failure experienced at Pickering unit 2.

44338 **(AECL—8338) Highlights of the metallurgical behaviour of CANDU pressure tubes.** Price, E.G. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. CANDU Operations). Oct 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702013.

This paper is an overview of the service induced metallurgical changes that take place in Zircaloy-2 and Zr-2.5 wt. percent Nb pressure tubes in CANDU reactors. It incorporates the findings of an evaluation program, that followed a significant pressure tube failure at Ontario Hydro's Pickering Nuclear Generating Station, and also provides valid reasons for continued confidence in the current CANDU design.

44339 **(BMI—1984-062) COD concept and its application to fracture mechanical evaluation of cracked components.** Kockelmann, H. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Dec 1984. 191p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752083.

Based on a comprehensive literature study, this report critically evaluates the current state of experiences with the COD concept in fracture mechanics. First the concept is explained and the procedure of materials testing with a view to fracture mechanics is discussed in detail with emphasis on: the definition of crack shape modification; the procedure to detect crack modification, with subsequent comparison; the determination of material characteristics; the impact on the characteristics of the crack tip opening and the dispersion of results. The correlation between crack tip opening characteristics and notch impact strength is explained, and the methods applied for analysis of the streses affecting the structural components are shown. The design-based and failure threshold curves and the treatment of real crack geometries are also discussed. Problems still to be solved are shown.

44340 **(CONF-810806—9) Simulation of a BWR fuel bundle under small break conditions.** Phillips, R.E.; Spore, J.W.; Weaver, W.L.; Giles, M.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 12p. NTIS, PC A02/MF A01 - GPO. File Number TI85015777.

From ANS conference on small break loss of coolant accident analysis in LWR's; Monterey, CA, USA (25 Aug 1981).

As part of the effort aimed at analyzing postulated loss-of-coolant accidents (LOCA) in Boiling Water Reactors (BWRs) the system simulation code, TRAC-BD1 has been developed at the Idaho National Engineering Laboratory. Among the specific features provided in this code is a BWR bundle model which includes: one-dimensional two-fluid hydrodynamics; multiple fuel rod capability; detailed radiation heat transfer model; channel wall heat transfer model; improved departure from nucleate boiling and rewet correlation. With these modeling capabilities, the TRAC-BDl fuel bundle model can simulate the thermal hydraulic conditions that would occur during both large and small break BWR LOCAs. To examine the ability of this model to accurately simulate the conditions in a BWR fuel bundle during a small break LOCA, a series of separte effects experiments have been modeled using TRAC-BDl. The results of this and previous studies indicate that the TRAC-BDl fuel bundle model can represent BWR fuel bundle behavior during the anticipated thermal hydraulic conditions of a postulated small break LOCA. 11 refs., 5 figs., 1 tab.

44341 **(CONF-850769—1) Technique of analysis and error detection for thermo-hydraulic system data.** Bordner, G.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015004.

From Conference on modelling and simulation; Storrs, CT, USA (1 Jul 1985).

Statistical techniques based on estimation theory were developed for the analysis of steady-state data from thermo-hydraulic systems, which could be either experimental loops or operating power plants. The method seeks to resolve errors in the component

heat balances which describe the system, to obtain system parameter estimates which are more accurate than the raw data, and to flag possible faulty sensors. Sample results are given for the analysis of test data from the Sodium Loop Safety Faciltiy (SLSF) P3 experiment.

44342 **(DOE/ID/01570—T97) Core spray heat transfer model for RELAP4/MOD7.** McCreery, G.E.; Jayne, G.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1977. Contract AC07-76ID01570. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016661.

A core spray heat transfer model that includes radiation and convective heat transfer has been developed for inclusion in RELAP4/MOD7 as part of the BWR reflood analysis capability. This report contains a description of the analytical model, the proposed method of adding the model to RELAP4, and a sample problem. 11 refs., 10 figs., 3 tabs.

44343 **(ECN—158) Phased mission analysis of maintained systems. A study in reliability and risk analysis.** Terpstra, K. (Netherlands Energy Research Foundation, Petten; Technische Hogeschool Eindhoven (Netherlands)). Sep 1984. 359p. NTIS (US Sales Only), PC A16/MF A01. File Number DE85701980.

The present study is devoted to system reliability and is mainly directed to the quantitative evaluation of accident sequences. Event tree methodology and fault tree analysis are applied as basic techniques. It introduces a new methodology for the calculation of the probability of occurrence of an accident sequence. This new methodology takes correctly into account shared equipment dependencies between the different systems present in an accident sequence. Since large and/or complex systems may contain a large number of minimal cut sets (sometimes millions of it), it is not possible as a rule to obtain the exact analytical solution. Therefore, upper and lower bounds for the probability of occurrence of an accident sequence are presented. Calculation results show that this probability is under-estimated if system dependencies are not fully taken into account. The new methodology also offers the possibility to get insight into the degree of dependency between systems based on quantitative calculations. To make the methodology manageable for complex systems, it is implemented in the reliability computer program PHAMISS. This program is written in FORTRAN-IV for the CDC-Cyber 175. PHAMISS is users friendly and has proven to be a fast and efficient program.

44344 **(EGG/LTR—16-13) Seismic stress analysis of LOFT Room B-100 cable tray supports.** Rahl, R.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 26 Mar 1979. Contract AC07-76ID01570. 16p. (EGG-RE-A—78-183). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015849.

Cable tray supports in Room B-100 of TAN 630 have been analyzed for seismic loading. Results indicate the supports were designed for vertical loads only and are not adequate for the horizontal g-loading of a LOFT Safe Shutdown Earthquake (SSE). Either braces or structure modifications are necessary on nearly all the cable tray supports in this room. 3 refs., 4 figs.

44345 **(EGG-M—11385) Reactor Safety Assessment System: a situation assessment aid for USNRC emergency response.** Bray, M.A.; Sebo, D.E.; Dixon, B.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1985. Contract AC07-76ID01570. 21p. (CONF-851072—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85011958.

From Expert systems in government symposium; McLean, VA, USA (23 Oct 1985).

The Reactor Safety Assessment System is an expert system under development for the United States Nuclear Regulatory Commission (NRC). RSAS is intended for use at the NRC's Operations Center in the event of a serious incident at a licensed nuclear power plant. The system uses plant parameter data and status information from the power plant. It has a rule base which uses the parametric values, the known operator actions and the time sequence information in the data to generate situation assessment conclusions for use by the NRC Reactor Safety Team. RSAS rules currently cover one specific reactor type and use setpoints specific to one power plant. 5 figs.

44346 **(EPRI-NP—3835) Determination of several LWR realistic success criteria for probabilistic risk assessment. Final report.** Rees, D.C.; Sawtelle, G.R.; Kripps, L.J. (Energy, Inc., Kent, WA (USA)). Jul 1985. 206p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920782.

This report documents Electric Power Research Institute (EPRI) Research Projects RP1842-6, "Determination of BWR Success Criteria for Probabilistic Risk Assessment," and RP1842-7, "Determination of PWR Success Criteria for Probabilistic Risk Assessment." Some Probabilistic Risk Assessments (PRAs) are based on conservative success criteria from the plant Safety Analysis Report (SAR) or estimated by hand calculations. A more realistic determination of success criteria would provide a better basis for assessing plant core damage frequencies and plant risk, as well as providing a basis for evaluation of emergency operating procedures and identification of the effect of operator action on accident prevention. EPRI Research Projects RP1842-6 and RP1842-7 developed and demonstrated an approach for realistically determining success criteria. Key elements in the approach are selection of PRA sequences to be analyzed, use of RETRAN to evaluate the sequences, and analysis of the results in terms of the impact on sequence frequencies and PRA results. This report describes the developed approach and demonstration results.

44347 (EPRI-NP—3912-SR-Vol.3, pp 134.1-134.10) **Multivariate statistical study for detection of failure trends and patterns in the analysis of events at nuclear power plants.** Samanta, P.K.; Levine, M.M.; Teichmann, T.; Kato, W.Y. (Brookhaven National Lab., Upton, NY). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

In this paper, a multivariate statistical method is presented and demonstrated as a means for analyzing nuclear power plant transients (or events) and detecting malfunctions and degradations within the course of the event based on operational data. The study provides the methodology and illustrative examples based on data gathered from simulation of nuclear power plant transients (due to lack of easily accessible operational data). Such an approach, once fully developed, can be used to detect failure trends and patterns and so can lead to prevention of conditions with serious safety implications.

44348 (EPRI-NP—3912-SR-Vol.3, pp 135.1-135.7) **Parametric Empirical Bayes methods for failure rate estimation.** Hill, J.R.; Koen, B.V.; Heger, S. (Univ. of Texas, Austin). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

The purpose of this paper is to develop a Parametric Empirical Bayes (PEB) model and estimator appropriate for many nuclear failure rate data sets. This work extends that of Dubau, Koen, and Georgin who first applied these types of estimators to reactor data. Hill, Koen, and Heger have further demonstrated the feasibility of using PEB methods for nuclear problems. Accurate failure rate estimates are important for meaningful probability risk assessments. The proposed PEB estimates improve upon Maximum Likelihood Estimates (MLE) when the PEB model is appropriate. Under this condition, these PEB estimates should be considered viable alternatives. First, a PEB model is developed. Second, a PEB estimator based on this model is proposed. Third, globe valve data from Nuclear Plant Reliability Data System provide an example of the application of the PEB estimator. Fourth, simulation results are given which indicate the superiority of the PEB estimator over the MLE. Finally, the authors offer concluding remarks summarizing results.

44349 (EPRI-NP—3912-SR-Vol.3, pp 139.1-139.9) **Methods of uncertainty propagation used in the analysis of safety systems of Angra-1: a comparison.** Fleming, P.V.; Oliveira, L.F.S.; Senna, V. (Programa de Engenharia Nuclear, Rio de Janeiro, Brazil). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

A probabilistic risk analysis (PRA) for the first Brazilian nuclear power plant, Angra-1, is currently underway. In a certain stage of the project a problem was faced of having to perform a large number of uncertainty propagation analyses for the unavailability evaluation of the safety systems of the plant. Several methods have been applied to solve the uncertainty propagation problem, among which, the Monte Carlo method (direct and discrete), the method of moments and the method of the discrete probability distributions have been the most often used. Since the only code available at the beginning of the PRA was the sample code, the authors decided to develop new codes using the above mentioned methods in order to perform a criterious comparison with the goal of establishing the advantages and limitations of each method when applied to real systems analyses. In this paper a summary is presented of the codes developed and the conclusions reached based on experience with the application of each one of them to some of the systems considered in the Angra-1 PRA.

44350 (EPRI-NP—3912-SR-Vol.3, pp 146.1-146.7) **Methodology for prioritization of systems and inspection programs.** Higgins, J.C.; Wong, S.M.; Azarm, M.A.; Pratt, W.T. (Brookhaven National Lab., Upton, NY). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

The purpose of this study was to develop a methodology to prioritize systems at a large Boiling Water Reactor Plant so that the Nuclear Regulatory Commission could effectively utilize their manpower resources to inspect the plant during the preoperational and startup phases. Systems were prioritized using PRA importance techniques based on core melt frequency and offsite consequences. This prioritization was then modified using system experience and problem information from the plant with a methodology specially developed for this purpose. Finally, recommendations were made for inspection program priorities taking into account both the prioritized lists that were developed and also nuclear systems and inspection-based engineering considerations.

44351 (EPRI-NP—3912-SR-Vol.3, pp 152.1-152.10) **Large-scale reliability analysis by decomposition and integration.** Watanabe, N.; Oikawa, T.; Tobioka, T.; Takama, N.; Kinoshita, A. (Japan Atomic Energy Research Institute). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

In this decade, the risk analysis for light water reactor nuclear power plants and other related facilities has become of remarkable importance. However, the plants or facilities to be analyzed are, in most cases, large-scale and complicated. Fault tree analysis for such a large-scale and complicated system often requires extremely time- and cost-consuming works. In this paper, a new method for the reliability analysis of the large-scale and complicated system (large-scale reliability analysis, hereinafter) is presented. The method enables the large-scale reliability analysis to be carried out practically and efficiently by decomposing the system into several subsystems and integrating the results obtained through reliability analyses for subsystems. For the demonstration of the methodology, a reliability analysis for a safety-related system of BWR nuclear power plants is provided. The merits of the method are confirmed by this application and the validity is shown by comparing the result with that of Interim Reliability Evaluation Program.

44352 (EPRI-NP—3912-SR-Vol.3, pp 169.1-169.10) **Development of success criteria and event trees for a BWR-6/Mark III plant.** Hsia, D.Y.; Wu, Y.F.; Filacchione, H. (Atomic Energy Council of the Republic of China). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

The Atomic Energy Council of the Republic of China is conducting a fullscope level-2 probabilistic risk assessment (PRA) for Taiwan Power Company's Kuosheng-1 unit which was the world's first operating BWR/6 with a Mark III containment. This paper presents the process for developing event trees and some key aspects of the event tree analysis. In the Kuosheng probabilistic risk assessment (PRA), only those initiating events are considered that could ultimately involve the reactor core. They are separated into internal and external initiating events. In this paper only the analysis of internal initiating events is discussed. First, the potential initiating events have been assigned to three general classes: (1) loss-of-coolant accidents, (2) transients with an automatic scram on demand, and (3) transients with a failure to automatically scram the reactor on demand. Then, these three general classes have been further divided in an iterative process with the development of the system success criteria and event trees.

44353 (EPRI-NP—3912-SR-Vol.3, pp 173.1-173.12) **Experiences from the Nordic Benchmark analyses.** Mankamo, T.; Petersen, K.E.; Poern, K.; Ericsson, G. (Technical Research Centre of Finland). Feb 1985. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $125.00. File Number TI85920541. (CONF-850206—Vol.3).

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

The Nordic project NKA/SAK-1, Probabilistic Risk Assessment and Licensing, is conducted with the research program of the Nordic Liaison Committee for Atomic Energy (NKA). The project is aimed at the verification and comparison of the methods and data bases for Level 1 PRA. The project is also aimed at a presentation of the guidelines for the application of probabilistic methods in the regulatory work including evaluation of its benefits and limitations. Two Benchmark studies formed an important part of the NKA/SAK-1 project. The first benchmark study was concerned with a high pressure injection system (HPIS). The system specification had been prepared on the basis of a system design that is typical of high pressure emergency core cooling systems in PWR plants. The second benchmark study concerned transients in which feedwater is lost in a BWR plant resulting in the need to depressurize the primary system in order to be able to use the low pressure injection systems.

44354 **(GRS-F—134) List of reports on reactor safety research from BMFT, CEA, EPRI, JSTA and USNRC.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Jan 1985. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752097.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning special Problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l' Energie Atomique (CEA), the Japan Science and Technologie Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these Reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programm of the BMFT, reporting organization. The list of reports appears quarterly.

44355 (GRS-F—138) List of reports on reactor safety research from BMFT, CEA, EPRI, JSTA and USNRC. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Oct 1984. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751872.

The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Program of the BMFT, reporting organization. The list of reports appears quarterly.

44356 (IKE—2-68) Experimental investigation of hydrodynamic fragmentation of gallium droplets in water flow. Kim, D.S. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Feb 1985. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751884.

In thermal detonation models, which describe vapor explosions with large masses of molten fuel and coolant, hydrodynamic fragmentation processes due to the great relative velocity between melt and coolant have been investigated. However, these thermal detonation models have merely used empirical correlations, which were obtained from experiments with liquid drops in gas streams, in order to describe the hydrodynamic fragmentation of melt. To examine the validity of such correlations for liquid-liquid systems, which are interesting with respect to vapor explosions, the fragmentation of single liquid gallium drops in steady and unsteady water flows produced by use of underwater wire explosions has been experimentally investigated. Additionally, the effect of high and short pressure pulses from the wire explosion on the fragmentation has been examined. The experimental results showed that the fragmentation of the drop generally occurs to be similar to that observed in experiments with liquid-gas systems. As a lower limit for the fragmentation, a Weber number of 30 was observed. For $100 < We < 1300$, the water flow drew off a thin closed gallium skin from the gallium drop, which finally broke up into small fragments. A stripping effect with direct formation of the fragments dominated for $1300 < We < 3520$. In the experiments with unsteady water flows, the draw-off of the drop surface was also the dominating fragmentation mechanism. The pressure pulses of the wire explosion did not have any effect on the fragmentation of gallium drops.

44357 (INFO—0095) Seismic qualification of equipment. A summary of findings. Heidebrecht, A.C.; Tso, W.K. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701961.

This report describes the results of an investigation into the seismic qualification of equipment located in CANDU nuclear power plants. It is particularly concerned with the evaluation of current seismic qualification requirements, the development of a suitable methodology for the seismic qualification of safety systems, and the evaluation of seismic qualification analysis and testing procedures.

44358 (INFO—0104) Canadian approach to nuclear power safety. Atchison, R.J.; Boyd, F.C.; Domaratski, Z. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701962.

The development of the Canadian nuclear power safety philosophy and practice is traced from its early roots at the Chalk River Nuclear Laboratory to the licensing of the current generation of power reactors. Basic to the philosophy is a recognition that the primary responsibility for achieving a high standard of safety resides with the licensee. As a consequence, regulatory requirements have emphasized numerical safety goals and objectives and minimized specific design or operating rules. The Canadian licensing process is described along with a discussion of some of the difficulties encountered. Examples of specific licensing considerations for each phase of a project are included.

44359 (INIS-mf—9711) Seismic effects on technological equipment and systems of nuclear power plants. Masopust, R.; Pecinka, L.; Podrouzek, J. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1983. 84p. (In Czech). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781556.

A survey is given of problems related to the construction of nuclear power plants with regard to seismic resistance. Seismic resistance of technological equipment is evaluated by experimental trials, calculation or the combination of both. Existing and future standards are given for the given field. The Czechoslovak situation is discussed as related to the construction of the Mochovce nuclear power plant. Procedures for testing seismic resistance, types of tests and methods of simulating seismic excitation are described. Antiseismic measures together with structural elements for limiting the seismic effects on technological equipment and nuclear power plant systems are summed up on the basis of foreign experience.

44360 (KFK—3557) Temperature escalation in PWR fuel rod simulators due to the zircaloy/steam reaction ESSI-4 ESSI-11. Hagen, S.; Kapulla, H.; Malauscheck, H.; Wallenfels, K.P.; Buescher, B.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Mar 1985. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752125.

The tests had the initial heatup rate as main parameter. The experimental arrangement consisted of a fuel rod simulator (central tungsten heater, UO_2 ring pellets and zircaloy cladding), a zircaloy shroud and the fiber ceramic insulation. A steam flow of ca. 20 g/min was introduced at the lower end of the bundle. A temperature escalation was observed in every test. The maximum cladding surface temperature in the single rod tests never exceeded 2200°C. The escalation began in the upper region of the rods and moved down the rods, opposite to the direction of steam flow. For fast initial heatup rates, the runoff of molten zircaloy was a limiting process for the escalation. For slow heatup rates, the formation of a protective oxide layer reduced the reaction rate. The test with less insulation thickness showed a reduction of the escalation. A stronger influence was found for the gap between shroud and insulation. This is caused by convection heat losses to the steam circulating in this gap by natural convection. Removal of the gap between shroud and insulation in essentially the same experimental arrangement produced a faster escalation. The posttest appearance of the fuel rod simulators showed that, at slow heatup rates oxidation of the cladding was complete, and the fuel rod was relatively intact. Conversely, at fast heatup rates, relatively little cladding oxidation with extensive dissolution of the UO_2 pellets and runoff of molten cladding was observed.

44361 (KFK—3828) Simulation of the effects on the time to rupture of unirradiated fuel rod cladding tubes of specific losses of coolant flow in the SNR-300 (emergency cooling cases). Schaefer, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1984. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751873.

The impacts on the time to rupture of unirradiated fuel rod cladding tubes of specific losses of coolant flow in the SNR-300, the so-called emergency cooling cases, were simulated by interrupting for several hours an internal pipe pressure stress-rupture test ($T=650°C$; $P=380$ atm. g) by a temperature transient ($T_{sub}(T)=850°C$; $P=50$ atm. g) after a test time of a few days. The residual time to rupture after the transient was determined experimentally and by calculation. Depending upon the duration of the transient it is between a few tenths of an hour and several hundred hours. During the period of high temperature the materials structure undergoes major changes, thus obviating calculation of the residual time to rupture in accordance with the life-fraction rule by Robinson. A life-fraction rule modified according to Mordfin et al. describes the existing results precisely, but is unable to predict them. A life-fraction rule taking into account structural changes

allows the respective materials damage and, hence, the residual time to rupture to be calculated.

44362 **(KFK—3847) Analysis of clad motion phenomena; application of the CMOT-II-code to clad melting experiments.** Henkel, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Feb 1985. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752096.

To the purpose of several out-of-pile experiments concerning clad behaviour under LOF-like accident conditions important phenomena of clad dynamics are discussed. These can be classified by the mode of motion into phenomena of film motion as well as droplet motion. The equations of the film model are discussed and recent modifications of different interaction terms are presented. A linear perturbation expansion of the film motion equations indicates the existence of so called dynamical and continuity waves. The second wave type seems to represent some aspects of the massive disturbance waves which are also observed in the experiments. In the context of wave appearance some details of clad dispersal (entrainment) are presented and entrainment rates and momentum transfer rates are specified. A discussion of some droplet flow characteristics follows which includes droplet deposition rates on surrounding structures. Several recalculations of the experiments are presented which have been done with an improved version of the CMOT-code including the considerations presented in the theoretical part. The comparison with experiment in regard to typical time scales of clad motion, two-phase pressure drops and final clad distribution leads to a satisfactory result.

44363 **(KFK—3856) Investigation on nuclear aerosols generated in the core melting facility SASCHA.** Albrecht, H.; Wild, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Feb 1985. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751909.

Investigations on core melt aerosols were performed under largely realistic conditions at the melting facility SASCHA. The following sampling techniques and analytical methods were applied: filtration, cascade impactor, aerosol centrifuge, alpha- and gamma-ray spectrometry, X-ray microanalysis, and Auger electron spectroscopy. The size distribution of the aerosol particles in a steam atmosphere was found to be log-normal with a median-value of the particle diameter of 0,09 μm and a geometric standard deviation of 2,13. Aerosol mass concentrations up to 30 g/m^3 were generated along with particle number concentrations in the range of 10^8 particles/cm^3. By microchemical analysis of the mixed aerosol it was found that each single particle contained most of the elements being present in the melt material and that the chemical forms of the particle constituents were mostly oxides but in some cases also hydroxides or the elemental forms.

44364 **(KFK—3861) Two-phase flow through small branches in a horizontal pipe with stratified flow.** Smoglie, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Dec 1984. 134p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85751882.

This report presents the description and results of experiments designed to determine the mass flow rate and quality through a small break at the bottom, the top or the side of a main pipe with stratified gas-liquid flow. If the interface level is far below (above) the branch, only single-phase gas (liquid) flow enters the branch. For smaller distances the interface is locally deformed because of the pressure decrease due to the fluid acceleration near the branch inlet (Bernoulli effect) and liquid (gas) can be entrained. This report contains photographs illustrating the flow phenomena as well as a general correlation to determine the beginning of entrainment. Results are presented on the branch mass flow rate and quality as a function of a normalized distance between the interface and the branch inlet. A model was developed which enables to predict the branch quality and mass flux. Results from air-water flow through horizontal branches, were extrapolated for steam water flow at high pressure with critical branch mass flux.

44365 **(KFK—3862) Two-phase flow through small branches in a horizontal pipe with stratified flow.** Smoglie, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Feb 1985. 139p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751901.

English translation published as KFK--3861.

In the field of reactor safety the occurrence of a small break in a horizontal primary coolant pipe is of great importance. This report presents the description and results of experiments designed to determine the mass flow rate and quality through a small break at the bottom, the top or the side of a main pipe with stratified gas-liquid flow. If the interface level is far below (above) the branch, only single-phase gas (liquid) flow enters the branch. For smaller distances the interface is locally deformed because of the pressure decrease due to the fluid acceleration near the branch inlet (Bernoulli effect) and liquid (gas) can be entrained. This report contains photographs illustrating the flow phenomena as well as a general correlation to determine the beginning of entrainment. Results are presented on the branch mass flow rate and quality as a function of a normalized distance between the interface and the branch inlet. A model was developed which enables to predict the branch quality and mass flux. Results from air-water flow through horizontal branches, were extrapolated for steam water flow at high pressure with critical branch mass flux.

44366 **(KFK—3872) Prediction methods in parametric signal models for early failure detection.** Scherer, K.P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Feb 1985. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751886.

For early detection of failures and critical phases in reactors by acoustic signals, it is important to recognize typical features very fast. A surveillance by parametric signal models is rater unknown. In this proposal it is shown, how to transform the acoustic signal in the feature space and how to generate several mathematical models in the feature space for the process. The ability to describe the physical process in such a way gives the possibility to apply forecast methods and different mathematical models and so the classification step can be preceded.

44367 **(KFK—3880/1) 5th international meeting on thermal nuclear reactor safety. Proceedings. Vol. 1.** Bork, G.; Rininsland, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Dec 1984. 761p. (CONF-840914—Vol.1). INIS Clearinghouse as microfiche KFK--3880/1.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

Published in 3 volumes.

The about 200 papers of the meeting, published in three volumes, are separately indexed in the data base.

44368 **(NUREG/CR—0672-Vol.1) Technology, safety and costs of decommissioning a Reference Boiling Water Reactor Power Station. Main report. Volume 1.** Oak, H.D.; Holter, G.M.; Kennedy, W.E. Jr.; Konzek, G.J. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RL01830. 304p. NTIS, PC A14/MF A01 - GPO. File Number TI85015936.

Technology, safety and cost information is given for the conceptual decommissioning of a large (1100MWe) boiling water reactor (BWR) power station. Three approaches to decommissioning, immediate dismantlement, safe storage with deferred dismantlement and entombment, were studied to obtain comparisons between costs, occupational radiation doses, potential dose to the public and other safety impacts. It also shows the sensitivity of decommissioning safety and costs to the power rating of a BWR in the range of 200 to 1100 MWe.

44369 **(NUREG/CR—0729) PWR blowdown heat transfer separate-effects program: Thermal-Hydraulic Test Facility experimental data report for test 171.** Clemons, V.D.; Craddick, W.G.; Flanders, R.M. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract AC05-84OR21400. 52p. (ORNL/NUREG/TM—277). NTIS, PC E04/MF A01 - GPO. File Number TI85015867.

Includes 2 sheets of 48x microfiche reduction.

Reduced instrument responses are presented for Thermal-Hydraulic Test Facility (THTF) test 171, which is part of the Oak Ridge National Laboratory Pressurized-Water Reactor (ORNL-PWR) Blowdown Heat Transfer Separate-Effects Program. The objective of the program is to investigate the thermal-hydraulic phenomenon governing the energy transfer and transport processes that occur during a loss-of-coolant accident (LOCA) in a PWR system. Test 171 was an isothermal test conducted to gain baseline information about the hydrodynamic behavior of the facility with the pressurizer surge line located upstream of the main heat exchangers. The primary purpose of this report is to make the reduced instrument responses during test 171 available. The responses are pressurized in graphical form in engineering units and have been analyzed only to the extent necessary to assure reasonableness and consistency. Microfiche data is included.

44370 **(NUREG/CR—0731) PWR Blowdown Heat Transfer Separate-Effects Program: Thermal-Hydraulic Test Facility experimental data report for test 161.** Clemons, V.D.; Craddick, W.G.; White, M.D. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract AC05-84OR21400. 52p. (ORNL/NUREG/TM—302). NTIS, PC E04/MF A01. File Number TI85015948.

Includes 3 sheets of 24x reduction microfiche.

Reduced instrument responses are presented for Thermal-Hydraulic Test Facility (THTF) test 161, which is part of the Oak Ridge National Laboratory Pressurized-Water Reactor (ORNL-PWR) Blowdown Heat Transfer Separate-Effects Program. The objective of the program is to investigate the thermal-hydraulic phenomenon governing the energy transfer and transport processes that occur during a loss-of-coolant accident (LOCA) in a PWR system. Test 161 was conducted to determine (through comparisons with tests 153 and 155) the effect of bundle outlet fluid temperature on the behavior of fuel rod simulator surface temperatures and surface fluxes in the THTF electric core. The primary purpose of this report is to make the reduced instrument responses during test 161 available. The responses are presented in graphical form in engineering units and have been analyzed only to the extent necessary to assure reasonableness and consistency. Microfiche data are included.

44371 **(NUREG/CR—0734) PWR Blowdown Heat Transfer Separate-Effects Program: Thermal-Hydraulic Test Facility experimental data report for test 164R.** Clemons, V.D.; Craddick, W.G.; Flanders, R.M. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract AC05-84OR21400. 47p. (ORNL/NUREG/TM—305). NTIS, PC E03/MF A01 - GPO. File Number TI85015868.

Includes 3 sheets of 24x reduction microfiche.

Reduced instrument responses are presented for Thermal-Hydraulic Test Facility (THTF) test 164R, which is part of the Oak Ridge National Laboratory Pressurized-Water Reactor (ORNL-PWR) Blowdown Heat Transfer Separate-Effects Program. The objective of the program is to investigate the thermal-hydraulic phenomenon governing the energy transfer and transport processes that occur during a loss-of-coolant accident (LOCA) in a PWR system. Test 164R was conducted to determine (through comparison with test 163) the sensitivity of fuel rod simulator surface temperatures and surface fluxes to alterations in electric core power and outlet temperature when the pressurizer surge line is located upstream of the main heat exchangers. The primary purpose of this report is to make the reduced instrument responses during test 164R available. The responses are presented in graphical form in engineering units and have been analyzed only to the extent necessary to assure reasonableness and consistency. Data are presented in microfiche form.

44372 **(NUREG/CR—0735) PWR blowdown heat transfer separate-effects program: Thermal-Hydraulic Test Facility experimental data report for test 165.** Clemons, V.D.; Craddick, W.G.; White, M.D. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract AC05-84OR21400. 53p. (ORNL/NUREG/TM—306). NTIS, PC E04/MF A01. File Number TI85015869.

Includes 3 sheets of 24x microfiche reduction.

Reduced instrument responses are presented for Thermal-Hydraulic Test Facility (THTF) test 165, which is part of the Oak Rdige National Laboratory Pressurized-Water Reactor (ORNL-PWR) Blowdown Heat Transfer Separate-Effects Program. The objective of the program is to investigate the thermal-hydraulic phenomenon governing the energy transfer and transport processes that occur during a loss-of-coolant accident (LOCA) in a PWR system. Test 165 was conducted to determine the effect of an intact hot leg on the behavior of fuel rod simulator surface temperatures and surface fluxes in the THTF electric core. The primary purposes of this report is to make the reduced instrument responses during test 165 available. The responses are presented in graphical form in engineering units and have been analyzed only to the extent necessary to assure reasonableness and consistency. (Microfiche data are included.)

44373 **(NUREG/CR—0891) Seismic review of Dresden Nuclear Power Station, Unit 2, for the systematic evaluation program.** Newmark, N.M.; Hall, W.J.; Kennedy, R.P.; Stevenson, J.D.; Tokarz, F.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1979. Contract W-7405-ENG-48. 193p. NTIS, PC A09/MF A01 - GPO. File Number TI85015864.

As part of Phase II of the Systematic Evaluation Program, a Senior Seismic Review Team performed a limited reassessment of the seismic resistance of the Dresden Nuclear Power Station, Unit 2. The reassessment focused generally on the reactor coolant pressure boundary and on those essential systems and components necessary to shut down the reactor safely and to maintain it in a safe shutdown condition following a postulated earthquake consistent with a zero period peak horizontal ground acceleration of 0.2 g. Unlike a design analysis, the reassessment was limited to structures and components deemed representative of generic classes. Conclusions and recommendations about the estimated ability of selected structures, equipment, and piping to withstand the postulated earthquake are presented. 69 refs., 69 figs., 22 tabs.

44374 **(NUREG/CR—1179) Application of the coupled fluid-structure code PELE-IC to pressure-suppression analysis: annual report to NRC for 1979.** McMaster, W.H.; Quinones, D.F.; Landram, C.S.; Norris, D.M.; Gong, E.Y.; Macken, N.A.; Nickell, R.E. (Lawrence Livermore National Lab., CA (USA)). Nov 1979. Contract W-7405-ENG-48. 139p. NTIS, PC A07/MF A01 - GPO. File Number TI85015862.

This report concludes a developmental effort to obtain a two-dimensional or axisymmetric computer code that calculates fluid-structure interaction problems in boiling-water-reactor (BWR) pressure-suppression systems. In this report several verification problems are concluded and applications to the Mark I and Mark II pressure-suppression systems are presented. 31 refs., 47 figs., 11 tabs.

44375 **(NUREG/CR—1274) Flaw preparations for HSST program vessel fracture mechanics testing: mechanical-cyclic pumping and electron-beam weld-hydrogen-charge cracking schemes.** Holz, P.P. (Oak Ridge National Lab., TN (USA)). May 1980. Contract AC05-84OR21400. 64p. (ORNL/NUREG/TM—369). NTIS, PC A04/MF A01 - GPO. File Number TI85015944.

Representative field testing to determine data for potential flaw propagation, fracture behavior, and margin against fracture for high-pressure-, high-temperature-service steel vessels subjected to increasing pressurization and/or thermal shock is premised on the investigators' ability to grow representative sharp cracks of known size, location, and orientation. Gaging for analytical stress and strain procedures and ultrasonic and acoustic emission instrumenta-

tion can then be applied to monitor the vessel during testing and to study crack growth. Cracks were grown by two techniques: (1) a mechanical method wherein a premachined notch was sharpened by pressurization; and (2) a method combining electron-beam welds and hydrogen charging to crack the chill zone of a rapidly placed autogenous weld. The mechanical method produces a naturally occurring growth shape controlled primarily by the shape of the machined notch; the weldinging-electrochemical method produces flaws of uniform depth from the surface of a wall or machined notch. Theories, details, discussions, and procedures are covered for both of the flaw-growing schemes. 21 refs., 33 figs., 3 tabs.

44376 **(NUREG/CR—1347) Thermocouple signal sensitivity to the sheath thickness of thermal-hydraulic test facility indirectly heated electric fuel pin simulators.** Dabbs, R.D.; Ott, L.J. (Oak Ridge National Lab., TN (USA)). Aug 1980. Contract AC05-84OR21400. 59p. (ORNL/NUREG—62). NTIS, PC A04/MF A01 - GPO. File Number TI85015942.

Analysis of data in large loss-of-coolant accident experimental facilities often requires extensive use of signals recorded from thermocouples embedded in indirectly heated electric fuel pin simulators (EFPS). These signals, converted to temperature, are used in the numerical determination of EFPS experimental conditions, inclusing transient surface temperature, transient surface heat flux, and transient internal radial temperature distribution. Important points that arise in uding the recorded thermocouple signals as a basis for subsequent analysis include (1) the effect of the distance that the thermocouple bead is located from the EFPS surface on the ability of the thermocouple to resolve rapidly changing boundary phenomena and (2) the extent that this depth influences the time response associated with the thermocouple. Several numerically solved EFPS transients (where boundary conditions were specified, and surface temperature, surface heat flux, and internal radial temperature histories were subsequently calculated) are presented in an effort to establish these two relationships and to form a foundation for recommending designs which will minimize the adverse effects of these relationships by specifying optimal thermocouple radial positions in future EFPSs.

44377 **(NUREG/CR—1359) Fabrication of sensors for high-temperature steam instrumentation systems.** Moorhead, A.J.; Herskovitz, M.B.; Morgan, C.S.; Woodhouse, J.J.; Reed, R.W. (Oak Ridge National Lab., TN (USA)). May 1980. Contract AC05-84OR21400. 56p. (ORNL/NUREG—65). NTIS, PC A04/MF A01 - GPO. File Number TI85015859.

A series of instruments is being developed for measurement of two-phase (steam and water) flow parameters in out-of-reactor safety tests that simulate a loss-of-coolant accident in a pressurized water reactor. We have developed a unique ceramic-to-metal seal system, which will withstand relatively short-time exposure to 800°C (1470°F) steam and remain leaktight after repetitive thermal transients of 300°C/s (540°F/s). A ceramic insulator was developed. This material is basically aluminum oxide containing a very fine dispersion of platinum nodules, which greatly enhance the thermal shock resistance of the hot-pressed cylinders. This insulator has little or no weight change on exposure to steam at 650 to 750°C (1200-1380°F) for over 100 h and has a helium leak rate of less than 0.005 mm^3/s after 25 quenches from 520°C (970°F) air into water at 80°C (175°F). The ceramic-to metal seal system consists of this insulator directly brazed to one or more metallic transition pieces with an ORNL-developed brazing filler metal having composition 49 Ti-49 Cu-2 Be (wt %). Thirteen highly complex instrumented guide tube assemblies, each containing a number of these ceramic-to-metal seals, have been fabricated, and seven were shipped to Germany for testing in an out-of-reactor safety test facility. Procedures were also developed for laser welding of sensor subassemblies into the tube wall, induction brazing of four stainless-steel-sheathed thermocouples through the tube wall, and furnace brazing of the eight triaxial cables, four thermocouples, and a vent tube where they passed through the upper end of the guide tube.

44378 **(NUREG/CR—1506) Water Reactor Safety Research Division quarterly progress report, January 1-March 31, 1980.** Romano, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). Jun 1980. Contract AC02-76CH00016. 69p. (BNL-NUREG—51218). NTIS, PC A04/MF A01 - GPO. File Number TI85015918.

The Water Reactor Safety Research Programs Quarterly Report describes current activities and technical progress in the programs at Brookhaven National Laboratory sponsored by the USNRC Division of Reactor Safety Research. The projects reported each quarter are the following: LWR Thermal Hydraulic Development, Advanced Code Evaluation, TRAC Code Assessment, and Stress Corrosion Cracking of PWR Steam Generator Tubing.

44379 **(NUREG/CR—1529) Two-phase flow measurements with advanced instrumented spool pieces.** Turnage, K.C. (Oak Ridge National Lab., TN (USA)). Sep 1980. Contract AC05-84OR21400. 33p. (ORNL/NUREG—72). NTIS, PC A03/MF A01 - GPO. File Number TI85015905.

A series of two-phase, air-water and steam-water tests performed with instrumented piping spool pieces is described. The behavior of the three-beam densitometer, turbine meter, and drag flowmeter is discussed in terms of two-phase models. Results from application of some two-phase mass flow models to the recorded spool piece data are shown. Results of the study are used to make recommendations regarding spool piece design, instrument selection, and data reduction methods to obtain more accurate measurements of two-phase flow parameters. 13 refs., 23 figs., 1 tab.

44380 **(NUREG/CR—1540) Lumped-parameter models for transient conduction in nuclear reactor components.** Wulff, W. (Brookhaven National Lab., Upton, NY (USA)). Jun 1980. Contract AC02-76CH00016. 41p. (BNL-NUREG—51231). NTIS, PC A03/MF A01 - GPO. File Number TI85015904.

Lumped-parameter models are presented for the prediction of transient conduction in cylinders, plane-parallel slabs, tubes and fuel elements under conditions of small-break loss of coolant accidents and planned transients in nuclear reactor systems. The model accounts for heat generation by fission and decay and by gamma absorption and water reaction. The models consist of ordinary differential equations, one each for the solid cylinder, the slab and the tube, and two for fuel pellet and clad in the fuel element. The differential equations are derived from the partial differential equation of energy conservation by volume averaging. The models can be applied to each axial node of a flow passage. The model formulation is particularly suitable for explicit integration over time with high-order integration schemes for ordinary, first-order differential equations.

44381 **(NUREG/CR—1567) TRAP: plotting package for TRAC.** Ferguson, J.C. (Los Alamos National Lab., NM (USA)). Aug 1980. Contract W-7405-ENG-36. 41p. (LA—8427-MS). NTIS, PC A03/MF A01 - GPO. File Number TI85015901.

The TRAP computer program is a versatile postprocessor routine that performs a variety of TRAC-data display tasks. (TRAC = Transient Reactor Analysis) TRAP (TRAC Plot) can graph curves, surfaces, and component structures and can easily be extended to more complex applications. Users communicate with TRAP by a sequence of command language statements allowing a high degree of flexibility in defining their plot requests. Output media for the resulting graphs include 16-mm or 35-mm (black and white or color), 105-mm (fiche) film, and direct imaging on a Tektronix terminal screen.

44382 **(NUREG/CR—1624-Vol.2) Load Combination Program. Progress report No. 6. Vol. 2.** Chou, C.K.; Lu, S.C.; Schwartz, M.W. (Lawrence Livermore National Lab., CA (USA)). Oct 1980. Contract W-7405-ENG-48. 43p. (UCRL—18674-Vol.2). NTIS, PC A03/MF A01 - GPO. File Number TI85015907.

This document is a progress report on the Load Combination Program (LCP) covering the period July 1, 1980 through September 30, 1980. The report gives a general description of the pro-

gram by project and tasks, together with financial summaries, technical reports generated, and meeting attendace. An appendix that discusses technical subjects is also included.

44383 **(NUREG/CR—1645) PWR loss-of-coolant accident analysis capability of the WRAP-EM system.** Gregory, M.V.; Beranek, F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1980. Contract AC09-76SR00001. 45p. (DPST-NUREG—80-1). NTIS, PC A03/MF A01 - GPO. File Number TI85015957.

The modular computational system known as the Water Reactor Analysis Package (WRAP) has been extended to provide the computational tools required to perform a complete analysis of loss-of-coolant accidents (LOCAs) in pressurized water reactors (PWR). The new system is known as the WRAP-EM (Evaluation Model) system and will be used by NRC to interpret and evaluate reactor vendor EM methods and computed results. The system for PWR-EM analysis is comprised of several computer codes which have been developed to analyze a particular phase of a LOCA. These codes include GAPCON for calculation of initial fuel conditions, WRAP (the previously developd SRL analog of RELAP4/MOD5) for analysis of the system blowdown and refill, the FLOOD option in WRAP for analysis of the reflood phase, and FRAP for the calculation of the behavior of the hot fuel pin. In addition, a PWR steady-state initialization procedure has been developed to provide the initial operating state of the reactor system. The PWR-EM system is operational and is being evaluated to determine the adequacy and consistency of the physical models employed for EM analysis.

44384 **(NUREG/CR—1691) Light-water-reactor safety research program. Quarterly progress report, January-March 1980.** Massey, W.E.; Kyger, J.A. (Argonne National Lab., IL (USA)). Aug 1980. Contract W-31-109-ENG-38. 23p. (ANL—80-86). NTIS, PC A02/MF A01 - GPO. File Number TI85015878.

This progress report summarizes the Argonne National Laboratory work performed during January, February, and March 1980 on water-reactor-safety problems. The research and development area covered is Transient Fuel Response and Fission-Product Release.

44385 **(NUREG/CR—1695) Experiment data report for LOFT nuclear small break experiment L3-5/L3-5A.** Dao, L.T.L.; Carpenter, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1980. Contract AC07-76ID01570. 291p. (EGG—2060). NTIS, PC A13/MF A01 - GPO. File Number TI85015880.

Uninterpreted data from the fourth nuclear small break loss-of-coolant experiment (Experiment L3-5/L3-5A) conducted in the Loss-of-Fluid Test (LOFT) facility are presented. The LOFT facility is a 50-MW(t) pressurized water reactor (PWR) system with instruments that measure and provide data on the thermal-hydraulic conditions during a postulated loss-of-coolant accident. The operation of the LOFT system is typical of large [~1000 MW(e)], commercial PWR operations. Experiment L3-5/L3-5A was conducted in two phases. The L3-5 phase in conjunction with Experiment L3-6, which will be conducted within the next few months, investigates the effect of pump operation on system response during a small break in the cold leg of the primary coolant system. The break size is equivalent to a 4-in. diameter rupture in a commercial plant, scaled on a break-area to system-volume basis. The principal variables investigated are system mass inventory and mass distribution. The L3-5 phase was a pumps-off experiment. The primary coolant pumps were tripped within a second of blowdown initiation which occurred immediately following reactor scram. The L3-5A phase evaluated the effectiveness of plant recovery by break isolation and steam generator "feed and bleed" cooldown. The potential for condensation cooling in the steam generator was also investigated.

44386 **(NUREG/CR—1709) ORMDIN: a finite element program for two-dimensional nonlinear inverse heat conduction analysis.** Bass, B.R.; Drake, J.B.; Ott, L.J. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Dec 1980. Contract AC05-84OT21400. 78p. (ORNL/NUREG/CSD/TM—17). NTIS, PC A05/MF A01 - GPO. File Number TI85015885.

The calculation of the surface temperature and surface heat flux from measured temperature transients at one or more interior points of a body is identified in the literature as the inverse heat conduction problem. Heretofore, analytical and computational methods of treating this problem have been limited to one-dimensional nonlinear or two-dimensional linear material models. This report presents, to the authors' knowledge, the first inverse solution technique applicable to the two-dimensional nonlinear model with temperature-dependent thermophysical properties. This technique, representing an extension of the one-dimensional formulation previously developed by one of the authors, utilizes a finite element heat conduction model and a generalization of Beck's one-dimensional nonlinear estimation procedure. A digital computer program ORMDIN (Oak Ridge Multi-Dimensional INverse) is developed from the formulation and applied to the cross section of a composite cylinder with temperature-dependent material properties. Results are presented to demonstrate that the inverse formulation is capable of successfully treating experimental data. An important feature of the method is that small time steps are permitted while avoiding severe oscillations or numerical instabilities due to experimental errors in measured data.

44387 **(NUREG/CR—1723) Nonlinear sensitivity and uncertainty analysis in support of the blowdown heat transfer program.** Ronen, Y.; Bjerke, M.A.; Cacuci, D.G.; Barhen, J. (Oak Ridge National Lab., TN (USA)). Nov 1980. Contract AC05-84OR21400. 44p. (ORNL/NUREG/TM—412). NTIS, PC A03/MF A01 - GPO. File Number TI85015894.

A nonlinear uncertainty analysis methodology based on the use of first and second order sensitivity coefficients is presented. As a practical demonstration, an uncertainty analysis of several responses of interest is performed for Test 177, which is part of a series of tests conducted at the Thermal-Hydraulic Test Facility (THTF) of the ORNL Engineering Technology Division Pressurized Water Reactor-Blowdown Heat Transfer (PWR-BDHT) program. These space- and time-dependent responses are: mass flow rate, temperature, pressure, density, enthalpy, and water qualtiy - in several volumetric regions of the experimental facility. The analysis shows that, over parts of the transient, the responses behave as linear functions of the input parameters; in these cases, their standard deviations are of the same order of magnitude as those of the input parameters. Otherwise, the responses exhibit nonlinearities and their standard deviations are considerably larger. The analysis also shows that the degree of nonlinearity of the responses is highly dependent on their volumetric locations.

44388 **(NUREG/CR—1773) Fission product release from BWR fuel under LOCA conditions.** Lorenz, R.A.; Collins, J.L.; Osborne, M.F.; Towns, R.L.; Malinauskas, A.P. (Oak Ridge National Lab., TN (USA)). Jul 1981. Contract AC05-84OR21400. 50p. (ORNL/NUREG/TM—388). NTIS, PC A03/MF A01 - GPO. File Number TI85015897.

Fission product release tests were performed with commercial fuel irradiated to 13,000 MWd/metric ton in the Peach Bottom-2 boiling water reactor under conditions that resulted in the accumulation of relatively large amounts of cesium and iodine fission products in the pellet-to-cladding gap space. Burst release tests (i.e., the rupture of prepressurized fuel rod segments, each 30.5 cm long) were performed at 850 and 960°C in steam, and one diffusional release test was performed at 1200°C with a previously ruptured test piece. In a fourth test, the pellet-to-cladding gap space of a test segment was purged with purified helium so that the amounts of cesium and iodine that were released from the gap space at temperatures ≦1100°C could be measured. The measured gap inventories were used as input parameters, and the burst release and diffusional release results for cesium and iodine were compared with predictions made from the previously published Source Term Model. Good agreement was obtained, thus adding confidence that the Source Term Model is valid for the full range of gap inventories anticipated for commercial light water reactor fuel. 20 refs., 18 figs., 17 tabs.

44389 (NUREG/CR—1800) Water Reactor Safety Research Division. Quarterly progress report, July 1-September 30, 1980. Abuaf, N.; Cerbone, R.J.; Levine, M.M.; Saha, P. van Roohen, D. (Brookhaven National Lab., Upton, NY (USA)). Nov 1980. Contract AC02-76CH00016. 66p. (BNL-NUREG—51298). NTIS, PC A04/MF A01 - GPO. File Number TI85015884.

A summary of all the experimental results for the Thermal/Hydraulic Development Program, i.e., pressure distributions, transverse distributions of the chordal averaged void fraction at given axial locations, and the area averaged void fraction distributions are presented. The effects of the flow parameters studied, i.e., inlet temperature, inlet mass flux and exit pressure on the recorded data are highlighted. RAMONA-III is being tested and modified to calculate small pipe break LOCAs in a BWR. The MARK II once-through steam generator model has been implemented in the IRT code and is currently being tested for an over cooling transient for a typical B & W plant. The version of the RETRAN code at BNL has been modified to improve the plotting capability on the BNL computer. Work on the independent assessment of TRAC-P1A has been terminated during the reporting quarter since an up-to-date version of TRAC i.e., TRAC-PD2, was received at BNL in July 1980. However, for the sake of completeness, a few simulations of the Super-CANON, RPI phase-separation, and FRIGG rod bundle tests have been performed with TRAC-P1A. The TRAC-PD2, Version 25.3, has been made operational on the BNL computer. Seven of the LASL-supplied sample problems have been run successfully.

44390 (NUREG/CR—1833) Seismic review of the Palisades Nuclear Power Plant Unit 1 as part of the Systematic Evaluation Program. Nelson, T.A.; Murray, R.C.; Wesley, D.A.; Stevenson, J.D. (Lawrence Livermore National Lab., CA (USA)). 15 Dec 1980. Contract W-7405-ENG-48. 181p. (UCRL—53015). NTIS, PC A09/MF A01 - GPO. File Number TI85015929.

A limited seismic reassessment of Unit 1 of the Palisades Nuclear Power Plant was performed by the Lawrence Livermore National Laboratory for the US Nuclear Regulatory Commission as part of the Systematic Evaluation Program. The reassessment focused generally on the reactor coolant pressure boundary and on those systems and components necessary to shut down the reactor safely and to maintain it in a safe shutdown condition following a postulated earthquake characterized by a peak horizontal ground acceleration of 0.2 g. Unlike a comprehensive design analysis, the reassessment was limited to structures and components deemed representative of generic classes. Conclusions and recommendations about the ability of selected structures and equipment to withstand the postulated earthquake are presented. 71 refs., 61 figs., 26 tabs.

44391 (NUREG/CR—1859) Systems interaction: state-of-the-art review and methods evaluation. Lim, J.J.; Rice, T.R.; McCord, R.K.; Kelly, J.E. (Lawrence Livermore National Lab., CA (USA)). 14 Nov 1980. Contract W-7405-ENG-48. 130p. (UCRL—53016). NTIS, PC A07/MF A01 - GPO. File Number TI85015930.

The Lawrence Livermore National Laboratory has conducted a state-of-the-art review of reactor systems interaction for the US Nuclear Regulatory Commission. This review includes developing a definition of the parameters and criteria for systems interaction; examining reported incidents from reactor operating experience; and evaluating existing and potential methodologies for evaluation of systems interaction. As a result of the review, recommendations and suggestions are made for developmental work of methodologies that show the best potential for near-term use.

44392 (NUREG/CR—1880) Initial quantification of human errors associated with reactor safety system components in licensed nuclear power plants. Luckas, W.J. Jr.; Hall, R.E. (Brookhaven National Lab., Upton, NY (USA)). Jan 1981. Contract AC02-76CH00016. 39p. (BNL-NUREG—51323). NTIS, PC A03/MF A01 - GPO. File Number TI85015932.

This report provides a methodology for an initial quantification of gross categories of human errors made in conjunction with several reactor safety system components operated, maintained, and tested in licensed nuclear power plants. The resultant human error rates provide the first real systems bases of comparison for the existing derived and/or best judgement equivalent set of such rates or probabilities.

44393 (NUREG/CR—1908) Criteria for safety-related nuclear power plant operator actions: initial pressurized water reactor (PWR) simulator exercises. Bott, T.F.; Kozinsky, E.; Crowe, C.; Haas, P.M. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract AC05-84OR21400. 101p. (ORNL/NUREG/TM—434). NTIS, PC A06/MF A01 - GPO. File Number TI85015985.

Nuclear plant control room simulator exercises for seven pressurized water reactor (PWR) events were conducted with ten control room teams. Operator performance was recorded by an automatic Performance Measurement System (PMS) and by subjective evaluation. Response times and error probabilities were estimated for selected actions. The effect of some experimental variables on operator performance is discussed. Application of the response time data to ANSI Standard N660 is included. The data collected will later be compared to field data being collected for similar events in order to provide a basis for extrapolation of simulator data to actual operating conditions. Ultimately, a base of human performance data will be developed from simulator experiments which can be used to establish criteria and standards, evaluate effects of key performance-shaping factors, and support safety/risk assessment analyses.

44394 (NUREG/CR—1909) Transient testing of an in-core impedance flow sensor in a 9-rod heated bundle. Hardy, J.E.; Leavell, W.H.; Liebert, H.; Mullens, J.A. (Oak Ridge National Lab., TN (USA)). Feb 1981. Contract AC05-84OR21400. 64p. (ORNL/NUREG/TM—389). NTIS, PC A04/MF A01 - GPO. File Number TI85016687.

An in-core instrumentation package that utilizes impedance sensors has been developed and fabricated to measure void fraction and two-phase flow velocity. The instrumentation package was designed to survive the severe thermal environment generated in the refill-reflood stage of a postulated loss-of-coolant accident and to detect small output signals from the sensors in a very noisy signal environment. An in-core impedance sensor was tested in a facility capable of simulating in-core, refill-reflood tests. The output signals produced by the sensor were analyzed by a transient algorithm to yield in-core two-phase void and velocity information. 34 figs., 6 tabs.

44395 (NUREG/CR—1919) Multirod Burst Test Program. Progress report, July-December 1980. Chapman, R.H. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract AC05-84OR21400. 48p. (ORNL/NUREG/TM—436). NTIS, PC A03/MF A01 - GPO. File Number TI85016007.

Six single rod heated shroud tests were conducted to investigate Zircaloy deformation in the beta temperature range. The tests were conducted under essentially constant heating conditions for rates in the range of 5 to 42°K/s. Burst temperatures were in the range of 1005 to 1106°C. Thin oxide layers formed during the tests. Energy released by the exothermic metal-water reaction contributed 2 to 3°K/s to the heating rate, independent of the total heating rate. This contribution is specific for the particular thermal hydraulics present in the tests and should not be considered generalized. Observed burst strains ranged from 58 to 104%. Burst strains observed in the slow ramp tests were greater than expected, while strains in the fast ramp tests were in better agreement with expectations. The B-4 (6 x 6) test array was completed and installed in the test facility in preparation for the burst test early in the next report period. Because test conditions selected for the bundle (~800°C and 5°K/s) are known to produce large deformation, the test should provide experimental evidence for or against axial propagation of deformation in large bundles. The B-5 (8 x 8) bundle is undergoing flow tests to characterize deformation with flow resistance. On completion of the flow tests, the bundle will be destructively examined to determine detailed deformation data.

44396 (NUREG/CR—1944) Comparison of the TRAC calculational results for the Slab Core Test Facility model and the reference German pressurized water reactor during reflood. Annual report, 1984. Smith, S.T. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 64p. (LA—8704-MS). NTIS, PC A04/MF A01 - GPO. File Number TI85015979.

A calculation through reflood and full-rod quenching has been made with the TRAC-PD2 model for the Slab Core Test Facility. The model was intended to simulate a typical German pressurized water reactor (GPWR) with combined hot-leg and cold-leg emergency core coolant injection. Results of this calculation were compared with a similar calculation for the GPWR. There was good overall agreement, with similar phenomena observed in both calculations for such parameters as liquid inventories, mass flow rates, upper plenum subcooling, and temperatures and pressures.

44397 (NUREG/CR—1946) Slab Core Test Facility steam supply design analysis with TRAC. Smith, S.T. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 37p. (LA—8702-MS). NTIS, PC A03/MF A01 - GPO. File Number TI85015980.

Early TRAC calculations for the Slab Core Test Facility indicated an external source of steam may be necessary to achieve refill and reflood behavior typical of a full-scale pressurized water reactor during a postulated loss-of-coolant accident sequence. To resolve this issue, a series of parametric calculations has been performed, using as a basis a set of five combinations of upper plenum and coal-leg emergency core coolant water temperatures. These cases were then run with ten parametric variations. The conclusion from this study is that the external steam source is unnecessary, but its inclusion would lend flexibility for future tests.

44398 (NUREG/CR—1981) Seismic review of the Oyster Creek Nuclear Power Plant as part of the Systematic Evaluation Program. Murray, R.C.; Nelson, T.A.; Ma, S.M.; Stevenson, J.D. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1980. Contract W-7405-ENG-48. 169p. (UCRL—53018). NTIS, PC A08/MF A01 - GPO. File Number TI85016019.

A limited seismic reassessment of Oyster Creek Nuclear Power Plant was performed by the Lawrence Livermore National Laboratory (LLNL) for the US Nuclear Regulatory Commission (NRC) as part of the Systematic Evaluation Program (SEP). The reassessment focused generally on the reactor coolant pressure boundary and on those systems and components necessary to shut down the reactor safety and to maintain it in a safe shutdown condition following a postulated earthquake characterized by a peak horizontal ground acceleration of 0.22 g. Unlike a comprehensive design analysis, the reassessment was limited to structures and components deemed representative of generic classes. Conclusions and recommendations about the ability of selected structures, equipment, and piping to withstand the postulated earthquake are presented. 86 refs., 44 figs., 19 tabs.

44399 (NUREG/CR—1991) TRAC-PD2 posttest analysis of CCTF Test C1-16 (Run 025). Sugimoto, J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 40p. (LA—8741-MS). NTIS, PC A03/MF A01 - GPO. File Number TI85015982.

The TRAC-PD2 code version was used to analyze CCTF Test C1-16 (Run 025). The results indicate that the core heater rod temperatures, the liquid mass in the vessel, and differential pressures in the primary loop are predicted well, but the void fraction distribution in the core and water accumulation in the upper plenum are not in good agreement with the data.

44400 (NUREG/CR—2000-Vol.4-No.6) Licensee Event Report (LER) compilation, June 1985. Volume 4, No. 6. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 130p. (ORNL/NSIC—200-Vol.4-No.6). NTIS, PC A07/MF A01 - GPO. File Number TI85015839.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during this period. The LERs, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries.

44401 (NUREG/CR—2020) Blowdown Heat Transfer Separate-Effects Program. Quarterly progress report, October-December 1980. Craddick, W.G.; Ott, L.J.; Anklam, T.M.; White, M.D.; Mullins, C.B.; Felde, D.K.; Mailen, G.S. (Oak Ridge National Lab., TN (USA)). Jun 1981. Contract AC05-84OR21400. 12p. (ORNL/NUREG/TM—449). NTIS, PC A02/MF A01 - GPO. File Number TI85015976.

Analysis of the first small break loss-of-coolant accident (LOCA) heat transfer test series was completed. The second small break LOCA heat transfer test series, consisting of 16 tests, was conducted. Analysis of the second transient film boiling test produced results consistent with those of the first such test - the Dougall-Rohsenow film boiling correlation substantially overpredicts the heat transfer. A series of steady-state film boiling tests and a third transient film boiling test were conducted. Initial evaluation of the in-bundle gamma densitometer system reveals anomalous results when fluid temperature exeeeds 589 K (600°F). 3 figs., 1 tab.

44402 (NUREG/CR—2052) ORNL small-break LOCA heat transfer test series I: rod bundle heat transfer analysis. Anklam, T.M. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract AC05-84OR21400. 116p. (ORNL/NUREG/TM—445). NTIS, PC A06/MF A01 - GPO. File Number TI85016003.

ORNL has experimentally investigated heat transfer and reflood under conditions similar to those expected in small-break loss-of-coolant accidents (SBLOCAs). Presented are results and analysis of the first of two series of uncovered bundle heat transfer tests. Specifically, a high-pressure high-temperature data base of experimental heat transfer coefficients and local fluid conditions has been compiled. In addition, a heat transfer model that accounts for forced convection and thermal radiation to steam has been developed to predict heat transfer coefficients under conditions typical of the subject tests. Experimental testing was performed at ORNL in the Thermal Hydraulic Test Facility (THTF), which is a large, high-pressure, electrically heated test loop configured to produce conditions similar to those expected in an SBLOCA. Under the subject test conditions, two heat transfer mechanisms were found dominant: (1) variable fluid property forced convection to superheated steam, and (2) thermal radiation to superheated steam and unheated structure.

44403 (NUREG/CR—2054) TRAC-PD2: advanced best-estimate computer program for pressurized water reactor loss-of-coolant accident analysis. (Los Alamos Scientific Lab., NM (USA)). Apr 1981. Contract W-7405-ENG-36. 425p. (LA—8709-MS). NTIS, PC A18/MF A01 - GPO. File Number TI85015981.

The Transient Reactor Analysis Code (TRAC) is being developed at the Los Alamos National Laboratory to provide an advanced best-estimated predictive capability for the analysis of postulated accidents in light water reactors. The TRAC-PD2 program provides this analysis capability for pressurized water reactors and for many thermal-hydraulic experimental facilities. The code features a three-dimensional treatment of the pressure vessel and its associated internals, two-phase nonequilibrium hydrodynamics models, flow-regime-dependent constitutive equation treatment, optional reflood tracking capability for both bottom flood and falling film quench fronts, and consistent treatment of entire accident sequences including the generation of consistent initial conditions. This manual describes the thermal-hydraulic models and the numerical solution methods used in the code. Detailed programming and user information also are provided.

44404 **(NUREG/CR—2114) ORNL small-break LOCA heat transfer test series I: high-pressure reflood analysis.** Anklam, T.M. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract AC05-84OR21400. 113p. (ORNL/NUREG/TM—446). NTIS, PC A06/MF A01 - GPO. File Number TI85016000.

Oak Ridge National Laboratory has experimentally investigated heat transfer and high-pressure reflood under conditions similar to those expected in a small-break loss-of-coolant accident (SBLOCA). This report addresses the results of a series of six high-pressure reflood tests that were run in January of 1980.

44405 **(NUREG/CR—2160) Water Reactor Safety Research Division. Quarterly progress report, January 1-March 31, 1981.** Romano, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). May 1981. Contract AC02-76CH00016. 61p. (BNL-NUREG—51401). NTIS, PC A04/MF A01 - GPO. File Number TI85016036.

Redirection of the R & D work on the development of a quantitative model for predicting SCC of Inconel 600 steam generator tubing is almost complete. RAMONA-3B was modified in order to broaden its applicability to boiling water reactor abnormal operational transients and accidents. The Simulator Improvement Program is being carried out. Existing simulator capabilities and limitations regarding their representation of the Nuclear Steam Supply System have been assessed. A special purpose high-speed peripheral processor is being selected for efficient simulations at real-time or faster computing speeds. An existing BWR system model and an advanced model for small break LOCA transients are being prepared for implementation on the peripheral processor. Independent assessment of TRAC-PD2 has continued with various separate-effect tests. An overcooling transient at Rancho Seco (March 1978) has been simulated by TRAC-PD2. A reactivity feedback model has been incorporated in this code.

44406 **(NUREG/CR—2182-Vol.1) Station Blackout at Browns Ferry Unit One - accident sequence analysis. Volume 1.** Cook, D.H.; Harrington, R.M.; Greene, S.R.; Hodge, S.A.; Yue, D.D. (Oak Ridge National Lab., TN (USA)). Nov 1981. Contract AC05-84OR21400. 242p. (ORNL/NUREG/TM—455/V1). NTIS, PC A11/MF A01 - GPO. File Number TI85015988.

This study describes the predicted response of Unit 1 at the Browns Ferry Nuclear Plant to Station Blackout, defined as a loss of offsite power combined with failure of all onsite emergency diesel-generators to start and load. Every effort has been made to employ the most realistic assumptions during the process of defining the sequence of events for this hypothetical accident. DC power is assumed to remain available from the unit batteries during the initial phase and the operator actions and corresponding events during this period are described using results provided by an analysis code developed specifically for this purpose. The Station Blackout is assumed to persist beyond the point of battery exhaustion and the events during this second phase of the accident in which dc power would be unavailable were determined through use of the MARCH code. Without dc power, cooling water could no longer be injected into the reactor vessel and the events of the second phase include core meltdown and subsequent containment failure. An estimate of the magnitude and timing of the concomitant release of the noble gas, cesium, and iodine-based fission products to the environment is provided in Volume 2 of this report. 58 refs., 75 figs., 8 tabs.

44407 **(NUREG/CR—2189-Vol.3) Probability of pipe fracture in the primary coolant loop of a PWR Plant. Volume 3. Nonseismic stress analysis. Load Combination Program, Project I final report.** Chan, A.L.; Lu, S.C.; Rybicki, E.F.; Curtis, D.J. (Lawrence Livermore National Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 72p. (UCID—18967-Vol.3). NTIS, PC A04/MF A01 - GPO. File Number TI85016044.

This volume describes the analyses used to evaluate stresses due to loads other than seismic excitations in the primary coolant loop piping of a selected four-loop pressurized water reactor nuclear power station. The results of the analyses are used as input to a simulation procedure for predicting the probability of pipe fracture in the primary coolant system. Sources of stresses considered in the analyses are pressure, dead weight, thermal expansion, thermal gradients through the pipe wall, residual welding, and mechanical vibrations. Stresses due to dead weight and thermal expansion are computed from a three-dimensional finite element model that uses a combination of pipe, truss, and beam elements to represent the reactor coolant loop piping, reactor pressure vessel, reactor coolant pumps, steam generators, and the pressurizer. Stresses due to pressure and thermal gradients are obtained by closed-form solutions. Calculations of residual stresses account for the actual heat impact, welding speed, weld preparation geometry, and pre- and post-heat treatments. Vibrational stresses due to pump operation are estimated by a dynamic analysis using existing measurements of pump vibrations. 13 refs., 16 figs., 11 tabs.

44408 **(NUREG/CR—2204-Vol.1) Advanced Two-Phase Flow Instrumentation Program. Quarterly progress report, January-March 1981. Volume 1.** Hardy, J.E.; Turnage, K.G.; McCulloch, R.W.; Davis, C.E.; Rogers, S.C.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). Jul 1981. Contract AC05-84OR21400. 21p. (ORNL/TM—7877). NTIS, PC A02/MF A01 - GPO. File Number TI85016024.

Development and evaluation of liquid level sensors for in-vessel use in pressurized-water reactors are described. A four-element heated thermocouple (HTC) level device was designed and fabricated to withstand loss-of-coolant accident thermal-hydraulic conditions. The multiple-position heated junction thermocouple was tested in a pressurizer over a wide range of conditions and will be installed and tested under a variety of accident conditions in the Semiscale Test Facility at EG & G Idaho. A single-element HTC was operated under high-void-fraction air and water flows to determine cooling effects of a mist. Data showed detectable cooling at surprisingly high void levels ($\alpha \sim 0.98$). A standpipe arrangement was tested in air and water to study the relationship between liquid level in the standpipe and flowing void of the surrounding media. Conceptual designs for a pressure seal technique in a reactor vessel for the ultrasonic level device (ULD) were discussed with a reactor vendor. Continued improvements, including interfacing the probe output with a Hewlitt-Packard HP85 calculator, were made with the ULD, thus improving the quality of the data produced.

44409 **(NUREG/CR—2363) Thermal-shock-resistant cermet insulators.** Morgan, C.S. (Oak Ridge National Lab., TN (USA)). Nov 1981. Contract AC05-84OR21400. 19p. (ORNL/TM—8038). NTIS, PC A02/MF A01 - GPO. File Number TI85015992.

Sensors capable of tolerating high-temperature steam and severe thermal shock have been produced for measurement of three-dimensional two-phase (steam and water) fluid flow parameters in two German and two Japanese nonnuclear reactor reflood test facilities. To satisfy the insulator requirements for sensors, we developed an Al_2O_3-Pt cermet material, which contains 0.5 to 1.5 vol % finely dispersed platinum. Repetitive water-quenching tests of these high-density (>97% of theoretical) insulators from 520°C followed by helium permeation measurements indicate that the cermets have high thermal shock resistance (TSR). Additionally, the cermets are unaffected by long-term exposure to high-temperature steam. The cermets are produced by hot pressing an Al_2O_3-Pt powder containing finely dispersed small-particle-size platinum nodules obtained by in situ reduction of a platinum chloride compound. Alumina-chromium cermets prepared by a similar in situ reduction procedure also possess improved TSR properties. The less expensive metal could make cermets applicable in more cost-conscious situations. 3 refs., 9 figs., 2 tabs.

44410 **(NUREG/CR—2366-Vol.1) Multirod Burst Test Program. Progress report, January-June 1981. Volume 1.** Longest, A.W. (Oak Ridge National Lab., TN (USA)). Dec 1981. Contract AC05-84OR21400. 179p. (ORNL/TM—8058). NTIS, PC A09/MF A01 - GPO. File Number TI85015998.

An attempt was made early in the report period to perform the planned burst test on the 6 x 6 bundle B-4. Posttest examination and evaluation of the 8 x 8 bundle B-5 continues. In tests involving potential rod-to-rod interactions, radial restraint must be simulated

if the results are to be valid for modeling bundle blockage. Preparations are under way to conduct the last planned bundle test (8 x 8 bundle B-6) in late 1981 or early 1982. Results are presented for six single rod heated shroud tests conducted during the report period.

44411 **(NUREG/CR—2486) Final results of the Hydrogen Igniter Experimental Program.** Lowry, W.E.; Bowman, B.R.; Davis, B.W. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1981. Contract W-7405-ENG-48. 57p. (UCRL—53036). NTIS, PC A04/MF A01 - GPO. File Number TI85015999.

Thermal igniters proposed by the Tennessee Valley Authority for intentional ignition of hydrogen in nuclear reactor containments have been tested in mixtures of air, hydrogen, and steam. The igniters, conventional diesel engine glow plugs, were tested in a 10.6 ft^3 pressure vessel with dry hydrogen concentrations from 4% to 29% hydrogen, and in steam fractions of up to 50%. Dry tests indicated complete combustion between 8% and 9% H_2, and no combustion for concentrations below 5%. Steam tests were done with hydrogen volume fractions of 8%, 10%, and 12%. Steam concentrations of up to 30% consistently resulted in ignition. Most of the 40% steam fraction tests resulted in combustion. In a few isolated cases the 50% steam fraction tests indicated a pressure rise. Circulation of the mixture improved combustion in both the dry and the steam tests, most notably at low H_2 concentrations. An analysis of the high steam fraction test data showed a high probability for the presence of small, suspended, water droplets in the test mixture. The suppressive influence of this condensation-generated fog on combustion is evaluated.

44412 **(NUREG/CR—4119) Integrity of containment penetrations under severe accident conditions. FY84 annual report.** Subramanian, C.V. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 35p. (SAND—85-0016). NTIS, PC A03/MF A01 - GPO. File Number TI85016540.

The knowledge of the leakage behavior of containments beyond design conditions is required for evaluation of severe accident mitigation strategies, risk studies, emergency preparedness, planning and siting. Strategies for managing these severe accidents will be severely hampered unless a methodology for predicting the timing, mode, and location of containment failure or leakage is developed. Five NRC programs - Experiments on Containment Models Under Extreme Loading Conditions, Containment Integrity Under Extreme Loads, Integrity of Containment Penetrations Under Severe Accident Loads, the Electrical Penetration Assemblies (EPAs), and Isolation Valves - are currently in place to evaluate containment integrity and the potential for leakage beyond design conditions. This report will summarize the work performed during FY84 for one of these programs - the Integrity of Containment Penetrations Under Severe Accident Conditions (henceforth called the Containment Penetration program).

44413 **(NUREG/CR—4281) Empirical analysis of selected nuclear power plant maintenance factors and plant safety.** Olson, J.; Osborn, R.N.; Thurber, J.A.; Sommers, P.E.; Jackson, D.H. (Battelle Human Affairs Research Centers, Washington, DC (USA)). Jul 1985. Contract AC06-76RL01830. 59p. (PNL—5487; BHARC—400/85/010). NTIS, PC A04/MF A01 - GPO. File Number TI85016166.

This report contains a statistical analysis of the relationship between selected aspects of nuclear power plant maintenance programs and safety related performance. The report identifies a large number of maintenance resources which can be expected to influence maintenance performance and subsequent plant safety performance. The resources for which data were readily available were related statistically to two sets of performance indicators: maintenance intermediate safety indicators and final safety performance indicators. The results show that the administrative structure of the plant maintenance program is a significant predictor of performance on both sets of indicators.

44414 **(NUREG/CR—4304) Pressure vessel fracture studies pertaining to the PWR thermal-shock issue: experiment TSE-7.** Cheverton, R.D.; Ball, D.G.; Bolt, S.E.; Iskander, S.K.; Nanstad, R.K. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 152p. (ORNL—6177). NTIS, PC A08/MF A01 - GPO. File Number TI85017300.

Thermal-shock experiment TSE-7 was conducted for the purpose of investigating the behavior of surface flaws under pressurized-water reactor (PWR) overcooling-accident conditions. This experiment was the eighth in a series of thermal-shock experiments conducted for this purpose with large steel cylinders (A 508, class-2 chemistry; 991-mm OD x 152-mm wall x 1.2-m length) as a part of the Heavy-Section Steel Technology (HSST) Program. The initial flaw for TSE-7 was a shallow, semielliptical, inner-surface, axially oriented, sharp crack located at midlength of the test cylinder. The thermal shock was applied to the inner surface only, and this was accomplished by effectively dunking the test cylinder, initially at ~93°C, into a large volume of liquid nitrogen. The specific purpose of TSE-7 was to determine whether, in agreement with analysis, a short and shallow surface flaw, in the absence of cladding, would extend on the surface to effectively become a very long flaw as a result of severe thermal-shock loading. During the experiment, there were three major initiation-arrest events. The first event consisted of some radial propagation and very extensive surface extension, with many bifurcations taking place. The second and third events consisted primarily of radial propagation. A fourth initiation event was prevented by warm prestressing. These results were in good agreement with predictions. 50 refs., 77 figs., 13 tabs.

44415 **(NUREG/CR—4331) Simplified seismic probabilistic risk assessment: procedures and limitations.** Shieh, L.C.; Johnson, J.J.; Wells, J.E.; Chen, J.C.; Smith, P.D. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 195p. (UCID—20468). NTIS, PC A09/MF A01 - GPO. File Number TI85016786.

The report summarizes the development of a simplified seismic probabilistic risk assessment (PRA) methodology. The purpose was to reduce the costs while adequately performing seismic probabilistic risk assessment of nuclear power plants. A simplified methodology for estimating seismic response directly from free-field ground acceleration was developed, including methods to account for the effects of soil-structure interaction, calibration of major structure response, and calibration of piping system response. Guidelines were developed for event/fault trees to be used in simplified seismic PRAs. 14 refs., 5 figs., 32 tabs. (ACR)

44416 **(NUREG/CR—4334) Approach to the quantification of seismic margins in nuclear power plants.** Budnitz, R.J.; Amico, P.J.; Cornell, C.A.; Hall, W.J.; Kennedy, R.P.; Reed, J.W.; Shinozuka, M. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 303p. (UCID—20444). NTIS, PC A14/MF A01 - GPO. File Number TI85017151.

The objective is to discuss progress to date in studying the issue of quantification of seismic margins in nuclear power plants. In particular, it deals with progress towards the establishment of review guidelines that would be useful in studying how much seismic margin exists. The work presented in this report is the result of a detailed study of seismic Probabilistic Risk Assessments, historical earthquake performance of the nuclear and non-nuclear facilities, and test date, augmented by the individual experience and expertise of the Panel members. The major development discussed in this report is the HCLPF concept, which demonstrates margin by showing that there is a High Confidence of a Low Probability of Failure for a given earthquake size. 38 figs., 62 tabs.

44417 **(NUREG-tr—0014) Zircaloy steam reaction and embrittlement of the oxidized zircaloy tube under postulated loss of coolant accident conditions. (Oxidation kinetics and embrittlement of zircaloy at above 1200°C).** Suzuki, M.; Kawasaki, S.; Furuta, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki). Nov 1977. 29p. NTIS, PC A03/MF A01 - GPO. File Number TI85901905.

In a loss of coolant accident in a light water reactor, the zircaloy cladding oxidizes due to reaction with steam and becomes brittle. Research began in 1957 into this reaction of zircaloy and steam at a high temperature, and many research reports have been subsequently issued on this problem of loss of coolant accidents in particular. However, there have been great disparities in these reports concerning reaction rate constrants so that independent data are required in even basic research from the standpoint of safety. Oxidation rates and ductile changes have been studied at reaction temperature ranges of 900-1200°C. Conversely, at temperatures above 1200°C, the time for the sample temperature to rise to the target value cannot be ignored in comparison to the reaction time at the target value temperature, and the difficult problem in terms of the experimental technology of temperature measurement also remains. In this study, one method of solving these problems is advanced and oxidation as well as ductile changes are studied at reaction temperatures above 1200°C. Moreover, the sample has been measured and changes in thickness of the ZrO_2 layer at reaction temperatures of 900-1200°C and of the ξ (oxide and α phase) layer have been studied. 10 refs., 13 figs., 4 tabs.

44418 **(RFP—3835) Finite element modeling of pulsed eddy current NDT phenomena.** Allen, B.; Ida, N.; Lord, W. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; Akron Univ., OH (USA). Dept. of Electrical Engineering; Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering). 15 May 1985. Contract AC04-76DP03533. 5p. (CONF-850641—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013221.

From 5. conference on the computation of electromagnetic fields; Ft. Collins, CO, USA (3 Jun 1985).

Transient fields for nondestructive testing (pulsed eddy current methods) have been used experimentally for such applications as coating thickness measurements and the inspection of reactor fuel tubing. The lack of suitable models to facilitate understanding of the interaction of the pulsed field with the test specimen has hindered a wider acceptance of the method as a tool in NDT. Two models, based on the finite element technique are described. The first model, used for repetitive pulse train sources makes use of the Fourier series of the source current to solve a steady state problem for each significant harmonic. The harmonic solutions are then summed to produce the total EMF in the pickup coil. The second model is used for single pulse application. The response is calculated using an iterative time stepping solution. In both cases axisymmetric geometries are studied using a magnetic vector potential formulation. Solutions are compared with experimental results. 3 refs., 3 figs.

44419 **(RRC—55) Radiation emergency preparedness (health physics and medical aspects): proceedings.** (Reactor Research Centre, Kalpakkam (India)). 1982. 297p. (CONF-8111228—). NTIS (US Sales Only), MF A01. File Number DE85900956.

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

During the past four decades the utilization of radioactive materials in medicine, agriculture, heavy industry and for electric power generation has become commonplace. Nuclear energy has the potential to cause accidental injuries similar to fire, electricity and thousands of chemicals that are a part of our daily living. A study of the source, cause and resulting injuries from past accidents involving the use of radioactive material, provides guidance on the management and prevention of such future events. In order to provide a forum to discuss in detail the key radiation protection and medical problems experienced in past accidents involving exposure to ionizing radiation, the IAEA organized its 4th Regional Seminar/Workshop on Emergency Preparedness - Health Physics and Medical Aspects. It was convened during the period of 30 November-11 December 1981 at Kalpakkam, India. This volume contains the proceedings of this seminar. It is hoped that the information provided will contribute to improved planning and response to radiation accidents as well as a better understanding of the relative degree of hazards from nuclear activities. (DT)

44420 (RRC—55, pp 63-66) **Radiation emergency preparedness for nuclear power plant in Korea.** Moon, P.S. (Korea Advanced Energy Research Institute, Seoul, Korea). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The Korean Ministry of Science and Technology (MOST) has focused its radiation emergency preparedness on situations that may occur or may threaten to cause radiological hazards affecting the health and safety of radiation workers as well as the general public. There are three phases of responsive action contained in the radiation emergency preparedness programme. The first phase would reduce initial actions directed toward the protection of personnel. The second phase would include immediate and planned action directed toward the termination of incident boundaries, establishment of control and channeling of information, and protection of the facility and equipment. The third phase would be to restore the facility to its normal operation condition. (DT)

44421 (RRC—55, pp 67-74) **Philippine Atomic Energy Commission National Radiological Emergency Preparedness/Response Plan for Nuclear Plant Incidents (master plan).** Lugtu, M.C.P. (Philippine Atomic Energy Commission, Quezon City). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The Philippine Atomic Energy Commission and the Office of the Civil Defense, National Disaster Coordinating Council has prepared a master plan for coping with radiological emergencies: the National Radiological Emergency Preparedness/Response Plan for Nuclear Power Plant Incidents. This master plan is in accord with PAEC regulations on emergency planning. 3 figs. (DT)

44422 (RRC—55, pp 75-88) **Emergency preparedness for the DAE Centre at Kalpakkam.** Amalraj, R.V.; Balasubramanian, G.R.; Gopinath, D.V.; Jayabarathan, S.; Krishnan, L.V.; Mathews, C.K.; Parameswaran, S.; Ramamurthi, M.K.; Shankar Singh, R. (Dept. of Atomic Energy, Kalpakkam, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

This report summarizes the emergency preparedness plans for the Indian Nuclear Energy Center at Kalpakkam. (DT)

44423 (RRC—55, pp 96-99) **Dousing incident at RAPS Unit I.** Sarma, M.S.R.; Sah, B.M.L.; Subbaratnam, T. (Rajasthan Atomic Power Station, Kota, India; Bhabha Atomic Research Centre, Bombay, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The light water dousing system of RAPS Unit I was actuated on December 18, 1980. The reactor was generating 190 MWe when a fuse in the control power supply unit to the ventilation system blew causing the reactor building (RB) isolation dampers to close with consequent increase in RB pressure. The protection system responded when the pressure crossed 18 g/cm² (0.25 psi) causing a reactor trip, unlocking the dousing valves and crash cooldown of the primary heat transport system. Air currents between the boiler room and the dousing area caused the anemometers to actuate dousing. About 400,000 gallons of light water were released through the dousing passages and filled the moderator room up to a depth of 5 meters.

44424 (RRC—55, pp 100-107) **Health physics aspects of the Windscale accident (October 1957).** Lister, B.A.J. (Atomic Energy Research Establishment, Harwell, Great Britain). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A review of the accident at Windscale in October 1957 is presented. (DT)

44425 (RRC—55, pp 130-135) **Training of emergency teams.** Nagel, E. (Eidgenoessisches Institut fur Reaktorforschung, Wuerenlingen, Switzerland). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Emergency teams must exist in every nuclear plant - in research centres where different laboratories and test reactors are located - as well as in nuclear power plants. All teams must be part of a duly organized Emergency Organization. This organization is responsible for the preparedness of the teams in accordance with the potential incident and accident locations of the site. It must be able to take care at any time of any nuclear or conventional emergency in the plant in order to protect the personnel, the surrounding population and the environment, to avoid or minimize damage to the installations and to assure safe operation or shut down of the facilities in an emergency situation. The teams should also be made available for assistance in nuclear emergencies outside the plant. 4 figs. (DT)

44426 (RRC—55, pp 136-143) **Emergency equipment.** Nagel, E. (Eidgenoessisches Institut fur Reaktorforschung, Wuerenlingen, Switzerland). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The Radioprotection Team, i.e., the entire Health Physics Division of the Institute for Reactor Research (EIR) at Wuerenlingen in Switzerland must be always prepared to intervene after a radiological accident occurring in one of the nuclear installations of the Institute. In order to be able to perform such tasks, it is necessary to have always a sufficient number of radioprotection instruments and other material available. The Institute has organized a store of instruments and material, which are continuously either controlled or renewed in order to be always ready for use, in case of internal or external emergencies. 3 figs. (DT)

44427 (RRC—55, pp 144-153) **Early investigation of an accident.** Lister, B.A.J. (Atomic Energy Research Establishment, Harwell, England). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

This discussion deals mainly with the early investigation of the effects of an accident and its causes. Focus is placed on the sort of accident that could well happen rather than on the catastrophe that is only a remote possibility. As the best lessons are learned from experience, this discussion draws on personal experience. 2 tabs. (DT)

44428 (SAND—85-1386C) **Effect of transverse venting on flame acceleration and transition to detonation in a large channel.** Sherman, M.P.; Tiezsen, S.R.; Benedick, W.B.; Fisk, J.W.; Carcassi, M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 45p. (CONF-850830—5). NTIS, PC A03/MF A01; GPO Dep. File Number DE85013777.

From 10. international colloquium on dynamics of explosions and reactive systems; Berkeley, CA, USA (4 Aug 1985).

The FLAME facility was built at Sandia National Laboratory, Albuquerque, NM for the US Nuclear Regulatory Commission to study flame acceleration, transition to detonation, and other hydrogen combustion problems relevant to nuclear reactor safety. The size of the structure is roughly half scale of the ice condenser upper plenum. The facility permits large-scale tests to be carried out with energetic (detonable) mixtures. The tests reported in this paper were carried out with the channel free from obstructions except for two 30-cm diameter mixing fans, each near opposite ends of the channel, and thermocouple instrumentation "rakes." The hydrogen concentration was varied up to stoichiometric and the degree of top venting used was 0%, 13% and 50%.

44429 (SAND—85-7201C) **Psychological scaling of expert estimates of human error probabilities: application to nuclear power plant operation.** Comer, K.; Gaddy, C.D.; Seaver, D.A.; Stillwell, W.G. (General Physics Corp., Columbia, MD (USA); Texas Maxima Corp., San Antonio (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850996—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013754.

From 29. Human Factors Society annual meeting; Baltimore, MD, USA (30 Sep 1985).

The US Nuclear Regulatory Commission and Sandia National Laboratories sponsored a project to evaluate psychological scaling techniques for use in generating estimates of human error probabilities. The project evaluated two techniques: direct numerical estimation and paired comparisons. Expert estimates were found to be consistent across and within judges. Convergent validity was good, in comparison to estimates in a handbook of human reliability. Predictive validity could not be established because of the lack of actual relative frequencies of error (which will be a difficulty inherent in validation of any procedure used to estimate HEPs). Application of expert estimates in probabilistic risk assessment and in human factors is discussed.

44430 (UCID—18668) **Technical evaluation of the electrical, instrumentation, and control design aspects of the low temperature overpressure protection system for the San Onofre Nuclear Power Station, Unit 1.** Latorre, V.R. (Lawrence Livermore National Lab., CA (USA)). Jun 1980. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01 - GPO. File Number TI85016675.

This report documents the technical evaluation of the electrical, instrumentation, and control design aspects for the low temperature overpressure protection system of the San Onofre Nuclear Power Station, Unit 1. Design basis criteria used to evaluate the acceptability of the system included operator action, system testability, single failure criterion, and seismic Category I and IEEE Std-279-1971 criteria. 23 refs.

44431 (UCID—18669) **Technical evaluation of the electrical, instrumentation, and control design aspects of the low temperature overpressure protection system for the Beaver Valley Nuclear Power Station, Unit 1.** Latorre, V.R. (Lawrence Livermore National Lab., CA (USA)). Jun 1980. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01 - GPO. File Number TI85016674.

This report documents the technical evaluation of the electrical, instrumentation, and control design aspects for the low temperature overpressure protection system of the Beaver Valley Nuclear Power Station, Unit 1. Design basis criteria used to evaluate the acceptability of the system included operator action, system testability, single failure criterion, and seismic Category I and IEEE Std-279-1971 criteria. 7 refs., 3 figs.

44432 (UCID—18670) **Technical evaluation of the electrical, instrumentation, and control design aspects of the low temperature overpressure protection system for the Trojan Nuclear Power Plant.** Latorre, V.R.; Victor, R.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1980. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01 - GPO. File Number TI85016673.

This report documents the technical evaluation of the electrical, instrumentation, and control design aspects for the low temperature overpressure protection system of the Trojan Nuclear Power Plant. Design basis criteria used to evaluate the acceptability

of the system included operator action, system testability, single failure criterion, and seismic Category I and IEEE Std-279-1971 criteria. 18 refs.

44433 **(UCID—18963) Technical evaluation of the susceptibility of safety-related systems to flooding caused by the failure of non-Category I systems for the Maine Yankee Atomic Power Station.** Epps, R.C. (Lawrence Livermore National Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01 - GPO. File Number TI85016717.

This report documents the technical evaluation of the Maine Yankee Atomic Power Station. The purpose of this evaluation was to determine whether the failure of any non-Class I (seismic) equipment could result in a condition, such as flooding, that might adversely affect the performance of the safety-related equipment required for the safe shutdown of the facility, or to mitigate the consequences of an accident. Criteria developed by the US Nuclear Regulatory Commission were used to evaluate the acceptability of the existing protection system as well as measures taken by Maine Yankee Atomic Power Company (MYAPC) to minimize the danger of flooding and to protect safety-related equipment. Based on the information supplied, we conclude that the licensee, Maine Yankee Atomic Power Company (MYAPC), has demonstrated in its analysis that the Maine Yankee Atomic Power Station has the capacity and capability to manage and mitigate any single incident, such as flooding from a non-Class I system component or pipe, so that this flooding will not prevent a safe shutdown of the facility. 7 refs.

44434 **(UCID—18964) Technical evaluation of the susceptibility of safety-related systems to flooding caused by the failure of non-Category I systems for Surry Units 1 and 2.** Latorre, V.R.; Victor, R.A. (Lawrence Livermore National Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01 - GPO. File Number TI85016718.

This report documents the technical evaluation of Surry Power Station Units 1 and 2. The purpose of this evaluation was to determine whether the failure of any non-Class I (seismic) equipment/piping could result in a condition, such as flooding, that might adversely affect the performance of the safety-related equipment required for the safe shutdown of the facility, or to mitigate the consequences of an accident. Criteria developed by the US Nuclear Regulatory Commission were used to evaluate the acceptability of the existing protection system as well as measures taken by Virginia Electric and Power Company (VEPCO) to minimize the danger of flooding and to protect safety-related equipment. Based on the information supplied by the licensee, it is concluded that the licensee, VEPCO, has demonstrated in its analysis that Surry Units 1 and 2 have the capacity and capability to manage and mitigate any single incident, such as flooding from a non-Class I system component or pipe, so that this flooding will not prevent the safe shutdown of the facility. 11 refs.

44435 **(UCRL—85704) Characteristics of the dynamic loading in a full scale multivent BWR pressure suppression system.** McCauley, E.W.; Weaver, H.J.; Aust, E.; Vollbrandt, J. (Lawrence Livermore National Lab., CA (USA); GKSS-Forschungszentrum Geesthacht G.m.b.H., Hamburg (Germany, F.R.)). Mar 1981. Contract W-7405-ENG-48. 17p. (CONF-810836—5). NTIS, PC A02/MF A01 - GP0. File Number TI85016720.

From 3. international seminar on the containment of fast breeder reactors; Ispra, Italy (24 Aug 1981).

Results from the full scale multivent pressure suppression experiment conducted by the GKSS Laboratory provides an improved basis for understanding of the dynamic, oscillatory steam condensation events and related loading functions which occur during the postulate loss-of-coolant accident in a boiling water nuclear reactor. Characterization of these phenomena with regards to their space, time, and frequency dependence is useful to the development of sound predictive computational procedures. 5 refs., 10 figs.

44436 **Thermodynamics of nuclear materials. Proceedings.** Flotow, H.E. Amsterdam, Netherlands; North-Holland (1985). 548p. (CONF-840807—).

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The topics of the sixth STNM cover a wide range of subjects in basic and applied thermodynamics, which are of current interest in the nuclear field. In particular, the editor would like to call attention to papers relating to nuclear safety, accident situations, and nuclear wastes.

44437 **Probability-based load combinations for design of category I structures - overview of research program and recent results.** Reich, M.; Hwang, H. (Brookhaven National Lab., Upton, NY (USA). Dept. of Nuclear Energy). *Nuclear Engineering and Design;* 79: No. 2, 129-135(May 1984). (CONF-830805—).

From 7. international conference on structural mechanics in reactor technology; Chicago, IL, USA (22 Aug 1983).

This paper discusses the probability-based load combinations for the program dealing with the design of Category I structures, currently being worked on at Brookhaven National Laboratory (BNL) for the Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission (NRC). The objective of this program is to develop a probabilistic approach for the safety evaluations of reactor containments and other seismic Category I structures subjected to multiple static and dynamic loadings. Furthermore, on the basis of the developed probabilistic approach, a load combination methodology for the design of seismic Category I structures will also be established. The major tasks of this program are: (1) establish probabilistic representations for various loads and structural resistance, (2) select appropriate structural analysis methods and identify limit states of structures, (3) develop a reliability analysis method applicable to nuclear structures, (4) apply the developed methodology to existing Category I structures in order to evaluate the reliability levels implied in the current design criteria, and (5) recommend load combination design criteria for Category I structures. When the program is completed, it will be possible to (1) provide a method that can evaluate the safety margins of existing containment and other Category I structures and (2) recommended probability-based load combinations and load factors for the design of Category I structures. At the present time, a reliability analysis method for seismic Category I concrete structures has been completed. By utilizing this method, it is possible to evaluate the safety of structures under various static and dynamic loads. In this paper, results of a reliability analysis of a realistic reinforced concrete containment structure under dead load, accidental pressure, and earthquake ground acceleration are presented to demonstrate the feasibility of the methodology.

44438 **(NUREG/TR—0054) Investigation of the phenomena occurring within a multi-compartment containment after rupture of the primary cooling circuit in water cooled reactors.** (Nuclear Regulatory Commission, Washington, DC (USA); Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Oct 1978. Translation of BF-RS 50-32-D1, March 1977. 120p. NTIS, PC A06 - GPO. File Number DE85901907.

The preceding experiments of Series C under Project RS 50 showed that the computer codes used for the design of reactor containments partly lead to estimates that are much too high. The subsequently devised experiments of Series D, being simplified idealized experiments, are to provide experimental data for the development of more accurate computer codes. Experiment D1 described here is the first of this series.

44439 **(NUREG/TR—0026) Identification of the oscillation behavior and system parameter estimation of pressure and core vessel of nuclear power plant BIBLIS-A.** Saedtler, E. (Nuclear Regulatory Commission, Washington, DC (USA); Technische Univ. Muenchen, Garching (Germany, F.R.). Lab. for Reactor Regulation and Plant Safety). Mar 1978. Translation of MRR-165, October 1976. 97p. NTIS, PC A05 - GPO. File Number DE85901898.

Previous investigations of the reactor vibrations have demonstrated that the pressure vessel and its internals perform pendular motions. In this report the identification of the vibrative behavior by use of modern estimation methods is described. Based on a double-pendulum lumped parameter model, the state vector enlarged by unknown system parameters is estimated from noisy preoperational measurements of the PWR BIBLIS-A. For this task a Maximum-A-Posteriori (MAP) identification algorithm was employed. 6 refs., 34 figs., 1 tab.

44440 **(NUREG/TR—0021) Behavior of the Zircaloy cladding tube in a mixed gas of hydrogen and steam.** Homma, K.; Furuta, T.; Kawasaki, S. (Nuclear Regulatory Commission, Washington, DC (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). Dec 1977. Translation of JAERI-7131, 6 Jun 1977. 28p. NTIS, PC A03/MF A01 - GPO. File Number TI85901901.

Effect of hydrogen/steam ratio on the reaction between zircaloy and hydrogen/steam mixed gas was studied in the temperatures between 950°C and 1100°C. When the ratio was less than a certain value, the amount of weight gain was almost the same as that in flowing steam only. Around the ratio the amount of weight gain fluctuated, and above the ratio, it decreased with increasing the ratio. The ratio at which fluctuation of weight gain was observed was 0.3 at 950°C, 0.4 at 1000°C, 0.25 at 1050°C and 0.2 at 1100°C. Severe embrittlement occurred in the specimens oxidized in the gas with higher ratio than that mentioned above. This phenomenon was caused by the absorbed hydrogen. Porous and thick oxide was produced on the specimens oxidized in the mixed gas close to the ratio mentioned above.

44441 **(NUREG/TR—0017) Factors influencing deformation and wall thickness of fuel rods under a loss-of-coolant accident.** Furuta, Teruo; Kawasaki, Satoru; Hashimoto, Masao; Otomo, Takashi. (Nuclear Regulatory Commission, Washington, DC (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). Nov 1977. Translation of JAERI-M 6542, April 20, 1976. 37p. NTIS, PC A03/MF A01 - GPO. File Number TI85901902.

The deformation of fuel during a loss-of-coolant accident is investigated extensively; it, however, is difficult to estimate it by LOCA analysis. In order to study experimentally the deformation of fuel rods, four types of pre-pressurized sham fuel rods filled with AL_4O_3 pellets to simulate UO_2 were heated in steam of vacuum under hypothetical LOCA conditions. The effects of various factors are described, including heating method, heating rate, atmosphere and the presence of pre-oxidized film in normal operation. Deformation data in the literature are also presented. The maximum circumferential strain of sham fuel rods is related to the burst temperature, and influences of the other factors become apparent. The average wall thickness of cladding varying with the deformation depends on the heating method and the atmosphere. It is found that the average wall thickness of fuel rods by induction heating is smaller than that by electric resistance furnace. 9 refs., 26 figs.

25 ENERGY STORAGE

2504 Capacitor Banks

44442 **(AD-A—154508/6/XAB) Capacitive energy storage at cryogenic temperatures. Final report, 1 September 1984-28 February 1985 on Phase 1.** Lawless, W.N.; Clark, C.F. (CeramPhysics, Inc., Westerville, OH (USA)). 15 Feb 1985. 43p. NTIS, PC A03/MF A01.

A Phase I research program on capacitive energy storage at liquid-nitrogen temperatures is reported. A composition in the cadmium-lead-niobate-tantalate family of ceramic ferroelectrics was chosen with a paraelectric to ferroelectric phase transition at 71 K (so-called CPN17 composition), and prototype multilayer capacitors (MLC's), 1 x 1 x 0.2 cm with 46 active layers, were fabricated for testing. Dielectric-constant, specific-heat, and electrocaloric data were measured on these MLC's in the range 77-100 K at electric fields up to 200 kV/cm. All the measured data can be explained and correlated very satisfactorily using a Ginzburg-Landau expansion of the free energy in combination with the TdS equation for dielectrics. Capacitive-energy-storage densities were computed from the measured electric-field dependence of the dielectric constant at 77 K using the Helmholtz integral. A state-switching phenomenon was observed. The zero-field specific heat of CPN17 is 0.15 J/g/K at 77 K and displays an excess specific heat centered around 82 K.

2506 Thermal

REFER ALSO TO CITATION(S) 44066, 44104, 44105, 44527

44443 **(CONF-801197—, pp 110-116) HPT technology and its effect on agri-business.** Levenson, W.L. (Levor, Inc.). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

A new power generating system has been developed that utilizes water as a "fuel". The system produces electrical energy and is called HPT (Heats of Phase Transition). It is described as a renewable, benign energy system that can be installed wherever water is available. The system is self-sustaining and the energy is primarily derived from the latent heat of fusion of water and is described as a "cold" engine. In addition to the electrical power generation which is claimed to be very efficient, a freezing capability exists in conjunction with power generation. This capability permits desalination, sewage treatment, cooling and potential for enhancement of many chemical processes. The effects of the technology in areas of agricultural application which would tend to improve the position of those involved in agri-business enterprises is described. HPT technology is considered the basis of a new science described as "cryodynamics."

44444 **(DTH-LV-MEDD—166) Heat storage by means of chemical heat pumping with aqueous salt solution as absorbent.** Dyrnum, O. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Nov 1984. 76p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752485.

Previous experiments have shown that heat storage by means of chemical heat pumping is a practical and technical possibility, but cheaper and more reactive absorbents must be found for a commercial exploitation of such a heat store. Possible absorbents which fulfil these demands are aqueous salt solutions, which until now have not been intensively examined for heat storage purposes. The theoretical background behind heat pumping and heat storage by means of heat pumping using aqueous salt solutions as absorbent is qualitatively evaluated, and well known examples of applications of chemical heat pumping are shown. Details in the absorption process are highlighted to show the importance of construction details and of the properties of the salt in question. Different designs of the heat pump and different salts are pointed out. Finally two examples of solar plants/heat stores with a power of 5.6 kW and heat storage capacities of 10,000 respectively 20,000 kWh are dimensioned. Calculations show present values for the plants 1.1-1.3 times greater than the investments.

44445 **(ORNL/TM—9530) Mixed clathrates for cool storage applications.** Carbajo, J.J. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015051.

Mixtures of refrigerants have been used to produce mixed-gas hydrates or clathrates at different pressures and temperatures. A clathrate at atmospheric pressure and at a temperature of 9.2°C (48.6°F) was obtained by using a mixture of Refrigerant-12 (R-12) and Refrigerant-11 (R-11). In addition, mixtures of R-12 and Refrigerant-114 (R-114) and of R-11 and R-114 have been tested. For these cases R-114 did not enter into the clathrate. Mixed hydrates or clathrates open new possibilities as the storage media for either cool or heat storage systems.

2509 Batteries

REFER ALSO TO CITATION(S) 44165, 44670

44446 (AD-A—154233/1/XAB) Constant-current discharge tests of a 12 d cell in-series Li/SO_2 battery pack under-counter arm-decoy requirements. Final report for FY 82. Buchholz, S.E.; DeBold, F.C.; Barnes, J.A.; Bis, R.F.; Kowalchik, L.A. (Naval Surface Weapons Center, Silver Spring, MD (USA)). Sep 1983. 25p. (NSWC-TR—83-366). NTIS, PC A02/MF A01.

The results of discharging a candidate Li/SO_2 Counter Army Decoy battery at 21 amperes are reported and discussed. The candidate battery consisted of 12 D size Duracell LO-26SH. None of the battery packs tested met the performance criteria of 28 volts + or - 2 for 5 minutes under a 21-ampere discharge. Three of the five batteries supplied were defective and could not be tested. One of these three had a defective cell and the other two had a high internal impedance. At voltage reversal, the two batteries that were tested reacted violently. One vented violently sending cells in all directions. The other also vented violently with torch-like flames. Capacities obtained under this test to a cut-off voltage of 2 volts were on the order of 2.80 and 3.03 amp hours.

44447 (LBL—19727) Reaction profiles in porous electrodes. Final report. Katan, T.; Carlen, P.J. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Lockheed Palo Alto Research Lab.). May 1985. Contract AC03-76SF00098. 80p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016512.

An experimental program was conducted to ascertain causes of alkaline zinc electrode shape change and to determine the development of reaction profiles within the pores of porous zinc electrodes. Various analog electrochemical cells were operated to isolate and evaluate the individual processes occurring during charge and discharge. It was found that both edge effects and osmosis can be responsible for the shape change phenomenon.

44448 (RISO-M—2496) Lithium alloys for negative electrodes. Steen Nielsen, T.; Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 81p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752497.

The purpose of this project is to prepare lithium alloys and to characterize their electrochemical properties to evaluate their application in solid state batteries as negative electrodes. The alloys were prepared in a DTA equipment in closed stainless steel crucibles by melting lithium together with the elements from the 2nd, 3rd and 4th main groups and the 2nd side group of the periodic system. The electrochemical properties of these alloys were examined by cyclic voltametry. Generally their free potentials with respect to lithium were +200 - +600 mV, which is the decrease in cell voltage obtained when a lithium alloy electrode is used instead of pure lithium. The discharge and charge rates of the alloys were evaluated from the maximum current densities obtained. Compared to β-LiAl, smaller current densities were generally observed for the alloys prepared from the metals of the 2nd main and side group except for LiHg, which however only contains 3 w/o Li. The alloys from the 3rd main group, of which Al also is a member, all showed about the same current densities, whereas some of the alloys from the 4th main group gave significantly higher current densities than β-LiAl. The highest values were observed for the compound $Li_{22}Sn_5$, which had a maximum current density three times that of β-LiAl. A technique for preparation of thin film LiAl electrodes by electroplating lithium on aluminium foils was developed. With this technique electrodes with a capacity of 25 C/cm^2 could be obtained. These electrodes showed much higher current densities than those prepared by melting.

44449 (SAND—85-7195) Zinc/ferricyanide battery development. Phase IV. Final report, 9 May 1983-15 February 1985. Hollandsworth, R.P.; Zegarski, J.; Selman, J.R. (Lockheed Missiles and Space Co., Palo Alto, CA (USA); Illinois Inst. of Tech., Chicago (USA)). May 1985. Contract AC04-76DP00789. 264p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85016026.

Project effort was concentrated on the technical evaluation of membrane cycle life of cost-effective membranes; and the study of the alkaline zinc/ferricyanide battery to meet goals of scale-up namely, refinement of a conceptual engineering design for a 50-kW solar photovoltaic storage system; determination of the cycle life of 60, 200, and 1000-cm^2 cells operating at capacities between 70 and 200 mAh/cm^2; and, development of compatible bipolar plastic electrode technologies. Numerous cost effective membranes were cyclically evaluated to determine the effects of ferricyanide upon the long term cycle life of the membrane. The results to data indicate a vast improvement over previous tests in that the new membranes endured the ferricyanide electrolyte with minor or no changes in performance during the 100+ cycles at 70-mAh/cm^2 capacity cycles which was used for preliminary performance testing. Postmortem evaluation revealed, however, that changes to the ionic groups attached to the membrane substrate had resulted in ion exchange capacity loss and increased resistance. Present data suggests that the membrane changes occur upon initial exposure to the battery electrolyte as electrochemical testing indicates stable cyclic efficiency performance.

44450 (UCRL—15686) Aluminum/air battery development. Final report. Knerr, L.A.; Wheeler, D.J. (ELTECH Systems Corp., Fairport Harbor, OH (USA). Research and Development Center). 15 Feb 1985. Contract W-7405-ENG-48. 196p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85016098.

The following chapters are included: (1) aluminum anode research, (2) electrocatalysts research, (3) air cathode development, and (4) air cathode evaluation and characterization. (MOW)

44451 Performance of advanced lead-acid batteries for load-leveling applications. Miller, J.F.; Gay, E.C.; Hornstra, G.F.; Yao, N.P. (Chemical Technology Division Argonne National Laboratory Argonne, IL). *Proceedings - Electrochemical Society;* **84-14**: 522-527(Oct 1984).

Testing and evaluation of advanced lead-acid batteries developed by Exide for load-leveling applications have been conducted at Argonne National Laboratory's National Battery Test Laboratory since April 1982. These batteries (36-kWh and 18-kWh modules) have a projected life of greater than 4000 deep-discharge cycles. This paper presents the results of performance and life tests obtained to date. Battery capacities and efficiencies are shown as a function of discharge rate. The status of ongoing accelerated life-cycle tests being conducted at 50°C and 60°C are presented.

29 ENERGY PLANNING AND POLICY

44452 (DOE/MA—0191) Uniform Reporting System: information pamphlet. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Jun 1985. 62p. H; GPO Dep. File Number TI85016328.

This pamphlet addresses some basic features of contract performance reporting. It is offered strictly as informative material and should not be construed as prescribing DOE policy, specific methods of organization, or management techniques. The official DOE policy documents which address uniform reporting systems and performance measurement systems requirements are DOE Order 1332.1A, Uniform Reporting System, 2250.1A, Cost and Schedule Control Systems Criteria for Contract Performance Measurement, respectively.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 43731, 44471, 44489

44453 (DOE/PE/70267—T14) Energy policy alliances and cooperative games: a survey of issues and solution concepts. Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Nov 1982. Contract AC01-80PE70267. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016766.

Energy and National Security Series: Discussion Paper D-82K.

This paper reviews obstacles to international agreement and of analytical approaches to describing foreign alliance formation and conflict resolution relative to energy security policies and preparedness. While these models provide useful intuitive insight on the nature of interactions among oil importing countries they have limited practical applicability in formulating testable hypotheses about international behavior. Thus to more fully understand international institutions created by sovereign nations to achieve greater energy security, different strands of the theory must be combined with factual knowledge and preceptions of different countries' incentives and objectives. The paper also reviews the public good nature of international agreements and the resulting obstacles to creating viable alliances. Subsequent sections provide a critical survey of various theoretical approaches to describing cooperative agreements. The concluding section summarizes deficiencies in existing theory and discusses the practical information required to better understand international institutions and behavior.

44454 (DOE/PE/70267—T32) Dynamics of International Energy Policy Coordination. Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Nov 1982. Contract AC01-80PE70267. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016765.

Energy and National Security Series: Discussion Paper D-82J.

This paper examines noncooperative decision making and gains from policy coordination over time, and it reviews some limitations of the dynamic noncooperative game approach. The next section contains a relatively simple dynamic game, or "supergame," model of noncooperative decision making. In sections three and four, sufficient conditions for existence of a noncooperative equilibrium are developed, and conditions are stated under which feasible strategies exist which give greater payoffs than noncooperative equilibrium choices. Thus these conditions imply that policy coordination would be mutually beneficial. It is seen that the assumptions required to prove existence of an equilibrium are substantial, so that even at this basic level the applicability of the game approach can be questioned. The focus of sections three and four is on "simple" strategies. These strategies are sequences of decisions which the players formulate at the outset of the game and which are subsequently followed regardless of the course of others' actions. Simple strategies are a direct analogue of strategies in a static game and thus offer limited scope for "strategic behavior" and other adaptations to changes over time. Sections five and six discuss these issues in turn. In section five, the range of strategies is broadened to incorporate "threats" and "tacit agreements" (without formal commitments) to undertake mutually beneficial departures from a simple strategy equilibrium. In section six, two approaches for explicitly modeling changing expectations as well as policy decisions are discussed. The paper concludes with a brief summary and a discussion of practical problems in applying the supergame models to international energy policymaking.

44455 (KFK—3881) Development of the SOPKA-E energy model into a goods entwinement model of national economy. Faude, D.; Klumpp, P.; Jansen, P.J.; Offermanns, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). May 1985. 202p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752674.

The energy paths have been elaborated by the Fact Finding Commission "Future Nuclear Energy Policy" of the Federal Parliament with a view to providing a rational basis for the manifold opinions prevailing in the Federal Republic of Germany as regards the future energy policy. The integration of the various energy supply structures in the national economy has remained unsettled. This implies the question of the "consistence related to economy" of an energy path. This work describes the development of the SOPKA-E energy model, used to calculate the energy paths, into the SOPKA-W good entwinement model with the objective of presenting the effects of different energy supply structures on the national economy. This required collection of comprehensive data related to economics, taking input-output tables as the basis, and editing these data for use in the model of computation. The work of collection and editing is treated in Chapter 2 for the initial base and in Chapter 3 for future development. Chapter 4 describes the basic layout of the SOPKA-W model as well as data implementation. Finally, in Chapter 5 and in the Annex the results are presented and evaluated of model computations regarding the energy paths 2 and 3.

44456 (PB—85-202216/XAB) Energy modelling with multiple objectives and multiple actors. Kok, M. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1984. 22p. (REPT—84-43). NTIS, PC E03/MF E01.

This paper is concerned with the use of multi-objective methods in an energy model of the Netherlands. The energy model and its objective functions are described. Furthermore, basic concepts in multi-objective programming are presented, concentrating on the question of how to organize the interaction between the computer model and the actors (decision makers). Finally, limits of this approach as well as the treatment of uncertainties in this model are discussed.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 43726, 43728, 43730, 43732, 43733, 43734, 43945, 44477, 44480, 44483, 44485, 44486, 44487, 44490, 44491, 44492, 44493, 44494, 44495, 44496, 44571, 45901

44457 (CONF-8505187—1) Implications and management of resource constraints: a community model for international development. Laitner, S. (Nebraska Energy Office, Lincoln (USA)). 1985. Contract FG47-80CS69097. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015799.

From 2. Pan-Pacific conference - a business, economic and technological exchange; Seoul, Korea (13 May 1985).

In the current economic climate and for the foreseeable future, resource policy (especially with respect to energy consumption) has the potential to make a profound impact upon the economic life of our communities. Energy and economic policies should be viewed as catalysts that can help a community - and ultimately a state, or even a nation - achieve larger societal goals such as enhanced employment opportunities. To achieve this potential, we must divorce ourselves from unproductive past concepts and understand the inherent constraints associated with resource utilization to better work them to the advantage of the community. The key element here is to ensure that community economic goals shape the policymaking process. Without such considerations neither communities nor their respective nations will be able to offset fully the growing economic burden imposed by restrictions arising from a "business-as-usual" approach to resource utilization.

44458 (DOE/ER—0171/2) Guide for the preparation of proposals for the Pre-Freshman Engineering Program: PREP - 1986. (USDOE Office of Energy Research, Washington, DC. University and Industry Programs Div.). Aug 1985. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016822.

The Pre-Freshman Engineering Program (PREP) will provide funds to colleges and universities for projects aimed at seeking out individuals during junior high school and high school years (7th grade through 10th grade) and providing them with pre-engineering enrichment experiences. These experiences shall consist of activities to identify, motivate and prepare students for engineering studies. Project duration for PREP summer activities should be no less than five weeks and preferably longer. Activities may include, but are not limited to, coursework in algebra, physics, chemistry, computer science, problem solving exercises, logic, etc., as well as motivational activities such as field trips and the use of role models. Emphasis is on the individuals identified, regardless of where they may decide to matriculate for undergraduate studies. It is highly desirable that the PREP activities of the proposing institution be correlated with and built upon the broader activities of the national efforts for pre-engineering education. Previous studies have shown that activities in this area should focus on the pre-college years. Therefore, preference will be shown for proposals which promise

to positively affect the younger, uncommitted student, (in grades 7 to 10), before firm decisions have been made not to take the appropriate science and mathematics courses.

44459 (PB—85-192102/XAB) Short-run energy-economy interactions in Egypt. Choucri, N.; Lahiri, S. (Massachusetts Inst. of Tech., Cambridge (USA). Technology Adaptation Program). Jul 1983. 71p. NTIS, PC A04/MF A01.

Much of the recent upsurge in the Egyptian economy has been provided by the strong, well-managed petroleum sector. Two obstacles to the continuation of these increased earnings are the highly subsidized domestic price of oil, which encourages domestic consumption, and the prevailing uncertainty as to reserve generation and the future production possibilities of oil. This report analyzes the effects of oil price increases, using a short-run ten-sector macro-economic model with explicit treatment of oil extraction, oil refining, and a sector consisting of electricity and natural gas. The macro-economic implications of domestic petroleum pricing strategies in Egypt are extremely important; an overall energy/economy strategy is required in which adjusting domestic prices toward international prices is only one element.

44460 Comparison of two baseline screening approaches to regional energy facility siting. Church, R.L.; Bell, T.L. (Univ. of California, Santa Barbara). *GeoJournal;* No. 3, 17-36(1981). Contract AS05-79EV10316.

Of the many approaches that might be used by policymakers to simulate the future locational pattern of energy facilities, baseline screening is the most straightforward. Based upon some composite of siting criteria measured for appropriate areal units, decision rules are developed to site energy facilities needed for projected demands. Two baseline methods, one developed at Oak Ridge National Laboratory and the other at Teknekron, Inc. are computerized and applied to the six state Middle Atlantic region. An earlier multiobjective optimization model developed by the Johns Hopkins University for the same region is used as a benchmark against which to compare the screening approaches. Both baseline models are found deficient when a trade-off between environmental suitability and economic efficiency is desired. A multiobjective heuristic model and an optimal transshipment model are developed to overcome the deficiencies inherent in baseline screening approaches. 7 references, 13 figures, 2 tables.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 43669, 43952, 43958, 45088, 45090, 45098, 45113, 45132, 45185, 45186, 45188

2904 Natural Resources

44461 (DOE/PE/70267—T26) Econometrics of exhaustible resource supply: a theory and an application. Epple, D. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267;AC02-79ET60003. 73p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016773.

Energy and National Security Series: discussion paper D-82R.

This report takes a major step toward developing a fruitful approach to empirical analysis of resource supply. It is the first empirical application of resource theory that has successfully integrated the effects of depletion of nonrenewable resources with the effects of uncertainty about future costs and prices on supply behavior. Thus, the model is a major improvement over traditional engineering-optimization models that assume complete certainty, and over traditional econometrics models that are only implicitly related to the theory of resource supply. The model is used to test hypotheses about interdependence of oil and natural gas discoveries, depletion, ultimate recovery, and the role of price expectations. This paper demonstrates the feasibility of using exhaustible resource theory in the development of empirically testable models. 19 refs., 1 fig., 5 tabs.

44462 (PER—86) World mineral energy resources and their distribution in time and space. Toens, P.D.; Camisani-Calzolari, F.A.G.M.; Van der Merwe, P.J.; Andreoli, M.A.G. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Jan 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702034.

If the estimated total geological potential of the world mineral energy resources is reduced to a common denominator, then the total resources are estimated at 20,600 terawatt years (TWyr). Assuming that all these resources are recoverable, and applying today's technology, they would suffice for 1,700 years under no-growth conditions and approximately 130 years assuming an annual growth rate of 3%. It should, however, be borne in mind that only about 15% (or 3,100 TWry) of the world's resources can be regarded as proved or partly proved and recoverable at current price levels and with current technology. Assuming a no-growth scenario, these resources will meet future energy requirements for a period of approximately 260 years. At a 3% annual growth rate resources will last for about 70 years. From these figures it is clear that the known mineral energy resources will be depleted in the near future. The challenge to the geologist to locate additional energy potential is enormous and in order to do so, the distribution of known resources in time and space was reappraised. The present investigation confirms the time-bound character of the mineralising processes. These took place in a series of clearly defined rhythms ranging from the early Proterozoic to the Recent. Uranium and thorium constitute the only energy resources of the Proterozoic. In contrast, the Phanerozoiceon contains the totality of fossil fuels and at least 60% of the nuclear resources; strata younger than 600 Ma therefore represent the most favourable target areas for prospecting.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 43933, 43935, 44452, 44479

44463 (DOE/BP—432) 1984 research and development yearbook. (USDOE Bonneville Power Administration, Portland, OR. Office of Engineering and Construction). Jun 1985. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016722.

Scope and rationale for BPA's research priorities are detailed.

44464 (DOE/CH/10146—1) Summary of recommendations for commercializing appropriate technologies in Michigan and for future appropriate technology projects. Final report. Stanton, T.S. (Michigan Energy and Resource Research Association, Detroit (USA)). 1985. Contract FG02-83CH10146. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016954.

This report covers the various phases of the project and discusses the findings and experiences of the project team in detail. In this advance summary are recommendations based on the completed project that are provided to emphasize needs recognized in the course of the project and to facilitate understanding and action by those concerned in Michigan government, businesses, schools, and citizenry. Some of the recommendations are specific while others must be stated in general terms. The project made clear that all programs intended to gain full realization of appropriate technology opportunities in Michigan must be carried out with patience, persistence, and continuing efforts over an extended period. The project also made it apparent that Michigan has an excellent chance, given such programs, to benefit greatly from appropriate technology development and utilization in the future.

44465 (PNL-SA—12976) Technology transfer is opportunity transfer. Levinson, T.M.; Schmid, L.C.; Watts, R.L. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 11p. (CONF-8506175—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016622.

From 10. annual meeting of the Technology Transfer Society; San Francisco, CA, USA (24 Jun 1985).

In this paper the management of intellectual property and the decision process of selecting federal technologies for transfer is approached from the perspective of how they can be packaged as business opportunities. The package is usually provided by a technologist who is the technology provider and the opportunity must be perceived as such by the business person. Thoughts are provided on the different perspectives of the technology provider and the technology seeker and the environment in which the transfer process occurs. The different perspectives and the environment can cause a disconnect between the research result and its uses. By using selection criteria based on the business person's perspective and by presenting the technology in terms of what it can become helps to mitigate this disconnect.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 43791, 45061

44466 **(AD-A—154744/7/XAB) Soviet campaign against INF (intermediate-range nuclear forces): strategy, tactics, means. Interim report.** Alexiev, A.R. (RAND Corp., Santa Monica, CA (USA)). Feb 1985. 56p. (RAND/N—2280-AF). NTIS, PC A04/MF A01.

Beginning in 1979, the Soviet Union mounted a major effort to prevent the deployment of NATO's INF (intermediate-range nuclear forces), which was scheduled to begin in 1983. The campaign failed to achieve its main objective, but it remains an instructive example of the Soviet effort to manipulate domestic trends in Western countries. This Note attempts to provide some insight into Soviet tactics and operational style. It places the INF issue within the framework of Soviet security concepts, reviews Soviet efforts to influence decision-making elites in West Germany against INF and to exacerbate U.S.-European friction within NATO, and analyzes the methods used by the Soviets in their campaign to co-opt the West German peace movement. The author finds that the campaign waged by the Soviets demonstrated a remarkable organizational and political capability that enabled them and their allies to exploit large numbers of noncommunists in West Germany, and contribute to the growing polarization of West German politics.

44467 **(CERN—84-14) Economic utility resulting from CERN contracts (second study).** Bianchi-Streit, M.; Blackburne, N.; Budde, R.; Reitz, H.; Sagnell, B.; Schorr, B.; Schmied, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 11 Dec 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702035.

The study attempts to quantify the economic benefit to high technology manufacturing industries involved in CERN contracts, in relation to their sales to CERN. It covers the period 1973-87 and complements an earlier study made in 1973-75 (see CERN Report 75-5). Interviews were carried out in 160 European firms, who supplied estimates of increased sales and cost savings due to CERN contracts. This "economic utility" totals 3107 million Swiss francs (up to the year 1987), compared to sales to CERN amounting to 748 million Swiss francs in 1982 prices. It is estimated that, by 1987, CERN's high technology purchases made in 1973-82 will have generated Economic Utility amounting to about 60% of the overall cost of the Organization during the same period. In 1982, about 75% of the increased turnover due to CERN resulted from sales to markets outside high energy particle physics, for example, railways, shipbuilding, refrigeration, power generation and distribution, and health care. The quantification model used is discussed in detail and some specific cases are presented as examples. The industrial managers interviewed during both studies have confirmed that the forecasts made ten years ago were, on average, accurate.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 44157, 44519, 44561

44468 **(DOE/MC/20241—1900) Gas turbine systems research and development CWM industrial energy system application study. Third topical report, October 1, 1984-May 31, 1985.** Giramonti, A.J. (United Technologies Research Center, East Hartford, CT (USA)). Jul 1985. Contract AC21-83MC20241. 193p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85015603.

Past attempts to develop advanced power generation systems burning coal-derived fuels have had limited commercial success. The reasons for this include continued technological difficulties, tightening environmental regulations, substantial economic risks, and the high cost of new technology demonstrations. One prospective way to expedite commercialization is to integrate the latest gas turbine technology identified during recent industrial and aircraft development programs with emerging technology for producing coal-derived fuels of intermediate quality. In this manner, the potential exists for leapfrogging to an attractive coal-burning power system without overwhelming research, development, and demonstration costs. United Technologies was one of three major contractors to complete a comprehensive systems analysis to conceptually define the "best" gas turbine power system operating on partially cleaned coal gas and coal-water mixture (CWM) fuels. While that study focused on large size electric utility power systems, it identified the potential for burning over-the-fence CWM in industrial cogeneration systems. Accordingly, the original study was expanded to include a Phase II effort which provided a comparable systems assessment of the merits of CWM use in industrial cogeneration applications. This assessment investigated the costs of owning and operating on-site equipment, the cost of fuel to meet electrical and thermal needs, and the cost of deficit electricity purchased from the utility or the value of surplus electricity sold to them. A screening study selected two industries for detailed analysis. The chlorine and PVC industries looked most attractive, so they were selected for detailed evaluation.

44469 **(CE-Trans—8105) District heating from Beznau Nuclear Power Station: first extention for Refuna in operation.** Handl, K.H. Translated from *Fernwaerme International ;* **12**: No. 6, 320-324(1983). 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902148.

Eleven months after the order was placed for the first plant for heat supply at the Beznau Nuclear Power Station of NOK, on 15 November 1983, district heat supply for the two Federal Institutes, EIR in Wuerenlingen and SIN in Villigen was started. The first important target for setting up the Regional district heat supply system for the lower Aaretal (Refuna) has been achieved. In the final stage of the scheme, a number of municipalities and large consumers will be obtaining heat from Beznau.

2910 Conservation

REFER ALSO TO CITATION(S) 43657, 44519, 44549, 44560

44470 (CONF-820849—, pp 470-477) **Monitoring energy use - what is needed?.** Harrje, D.T. (Princeton Univ., NJ). 1984. NTIS, PC A25/MF A01. File Number DE84014927. Contract AC02-77CS20062.

From Summer study in energy efficient buildings; Santa Cruz, CA, USA (22 Aug 1982).

Monitoring energy use in buildings can vary widely in complexity depending upon the particular task and how much information is already known about the given building. For example, approaching an energy monitoring problem in which there are questions as to what are the critical parameters to measure may require extensive instrumentation in the initial evaluation stage but a subsequent series of tests may require only a few key measurements. The questions of appropriate sensor and recording choice are far from static. The range of choices for monitoring has changed dramatically over the past 10 years with the development of the microcomputer and microprocessor.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 43727, 43730, 44480, 44481, 44482, 44489

44471 (PB—85-189587/XAB) EC (energy conversion) medium-term energy-demand model: present state and recent results. Rubin, R. (Commission of the European Communities, Luxembourg). [1985]. 37p. (EUR—9011-EN). NTIS, PC E03/MF E03.

A short description of the EC medium term energy demand model is given. Its main structure and application potential is explained. The operational status of the models for the different EC countries is given. Results of recent model simulations for all EC countries are presented and discussed. Conclusions are drawn from a comparative analysis using national forecasting results. An assessment is made, in how far such types of models can explain and forecast the behavior of energy demand in conjunction with the corresponding macroeconomic and sectoral economic developments.

44472 (PB—85-199990/XAB) Energy situation in Jordan. Badran, I. (Ministry of Industry, Trade and Tourism, Amman (Jordan)). Oct 1984. 51p. NTIS, PC A04/MF A01.

The report briefly reviews the energy problem in the world, and then studies in detail the situation in Jordan. It covers the energy supply of crude oil, refined products, and non-commercial energy; energy demand; the current pattern of energy consumption of oil and electricity; a forecast of energy demand; the government subsidy of energy; new energy resources in Jordan (oil exploration and oil shale, tar sands, radioactive minerals, and renewable energy sources including geothermal, hydropower, solar, and wind). The report concludes that alternative energy sources must be developed by Jordan to meet the increased demand for energy and to reduce the dependence of Jordan on oil in the next decades.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 43739, 43740, 43741, 43952, 44131, 44457, 44472, 44487, 44490, 44494, 44495, 44496

44473 (AD-A—154863/5/XAB) Nonnuclear strategic weapons: implications for arms control policy. Platt, A.; Vick, A. (RAND Corp., Santa Monica, CA (USA)). Dec 1984. 21p. (RAND-P—7044). NTIS, PC A02/MF A01.

The future acquisition of nonnuclear strategic weapons (NNSW) is likely to have profound consequences for a wide range of U.S. foreign and defense policy issues. This paper examines the implications of NNSW acquisition for arms control policy, focusing on the most salient technological, strategic, and political considerations associated with the introduction of this weaponry. Today's tactical precision guided munitions (PGMs) and sensor technologies may well be harbingers of a future wherein NNSW are an essential element in U.S. strategic forces. There are already visible portents of this. In July 1983, for example, the U. S. Congress explicitly put itself on record in favor of certain advanced conventional munitions as compared to nuclear munitions when it deleted funding for the W82 nuclear projectile for the 155mm cannon and replaced it with $50 million in new monies for improved conventional munitions. This sort of substitution of conventional for nuclear munitions--or as some argue, competition between nuclear and conventional capabilities--is a growing phenomenon and is likely to remain so. In the near-term, NNSW will probably be deployed on a gradual basis foe specialized missions.

44474 (AD-A—154979/9/XAB) Arms control and crisis-management potential of the proposed International Satellite Monitoring Agency (ISMA). Ranger, R. (Operational Research and Analysis Establishment, Ottawa, Ontario (Canada)). Dec 1984. 140p. NTIS, PC A07/MF A01.

This study investigates the potential contribution of an International Satellite Monitoring Agency (ISMA) to the verification of compliance with arms control agreements and also to crisis management. The basic characteristics of an ISMA and the theoretical bases for its contribution are outlined, as are the potential practical difficulties it is likely to encounter in principle. An assessment is then given of the limitations of verification capabilities and the resultant problems posed for compliance policy in a representative selection of arms control agreements - those limiting strategic nuclear forces, chemical and biological weapons and, in the inter-war years, naval forces. The conclusion is that there are considerable technical and political limits on verification capabilities and on enforcing compliance with such agreements. These limits have proved significantly larger than anticipated in the arms control literature. They suggest that an ISMA would have difficulty, in practice, in making the contribution to arms control envisaged in theory. A similar conclusion applies to the more-demanding task of contributing to crisis management.

44475 (DOE/EP/14018—T1) Role of the private sector in energy emergencies. Executive summary. (Center for Strategic and International Studies, Washington, DC (USA)). 1982. Contract FG01-82EP14018. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016468.

The policy environment for energy emergency planning has changed as a result of the election of Ronald Reagan. This was made clear by the President's veto of the Standby Petroleum Allocation Act of 1982 (S.1503) signifying once and for all the death of the allocation approach to coping with future energy emergencies. Recognizing this change in policy attitudes, the Georgetown University Center for Strategic and International Studies, with funding assistance from the US Department of Energy, is sponsoring a series of three meetings on energy emergency planning. The first, held on June 7, 1982, focused on the role of the private sector in energy emergencies.

44476 (DOE/PE/70399—T7) Japan and the Middle East in alliance politics. Conference report. Morse, R.A. (ed.). (Woodrow Wilson International Center for Scholars, Washington, DC (USA)). Jun 1985. Contract FG01-82PE70399. 19p. Woodrow International Center for Scholars, Smithsonian Inst., Bldg. 1000, Jefferson Dr., SW, Washington DC 20560. File Number TI85013139.

The reason for holding this conference was to examine in a serious way the increasingly close Japan-Middle East relationship, and place this relationship in a cultural and political setting. The idea was to broaden our understanding about what is usually discussed only in terms of energy needs and trade ties. While there are no major problems in the Japan-Middle East relationship, it is a topic of critical importance for understanding the future of Middle East-advanced nations relations. The Asia Program, which follows Japanese affairs, and the International Security Studies Program, which deals with Middle Eastern affairs, teamed up to find experts to represent a good cross section of the issues that needed to be addressed.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 43657, 43669, 43707, 43726, 43727, 43728, 43729, 43730, 43731, 43732, 43733, 43734, 43735, 43740, 43741, 43742, 43744, 43940, 43941, 44459, 44472

44477 (DOE/EI/19684—T1) Survey on retail and wholesale prices, and primary stock inventory data for residential No. 2 heating oil. End of survey report, State of Rhode Island, October 1, 1984-May 31, 1985 . (Rhode Island State Fuel Allocation Office, Providence (USA)). May 1985. Contract FG01-84EI19684. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016648.

Results of surveys conducted to monitor prices of residential and rack No. 2 heating oils and inventories during the 8 month period ending May 31, 1985 in Rhode Island are reported. Dealer margins on October 1, 1984 averaged $0.2420 per gal. On May 1, 1985, the average margin was $0.2730 per gal. The residential price trend rises and falls in proportion to change in the rack price as fluctuations in the market are reflected in the consumer price. (DMC)

44478 **(DOE/NBM—5017015) Analysis of the impacts of the President's tax proposal on major sectors of the energy industry.** (USDOE Energy Information Administration, Washington, DC). Aug 1985. 127p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE85017015.

The purpose of this study is to assess the impact of the President's tax proposal on the energy sector. The study consists of two parts. The first part specifically addresses the impacts of the President's tax proposal on the oil and gas, coal, and electric utility sectors of the energy industry. Impacts were examined at both the project and corporate levels. The study focuses on proposed changes in corporate income taxation. Results show that the impacts of the President's tax proposal vary across the energy sector. Taxes levied on coal operations would rise. Those levied on oil and gas remain about the same if measured at the overall corporate level. Looking at oil and gas production operations separately from other lines of business (downstream, foreign, and subsidiary operations), taxes would tend to fall, except in the case of the small independents. Taxes paid by electric utilities would tend to fall. Within each sector, however, substantial variation among firms would be evident due to differing circumstances of corporate diversity and rate of growth. 11 figs., 38 tabs.

44479 **(DOE/PC/60408—T1) Biomass and coal conversion programs of the USAID/GOI Alternative Energy Resources Development Project. Trip report to India, May 22-June 2, 1983.** (Viking Energy Corp., Pittsburgh, PA (USA)). 1983. Contract AC22-83PC60408. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017295.

India processes huge coal resources and produces almost 200 million tons of agricultural residue annually. To reduce balance of payments caused by imported oil, India will have to utilize this resource base for conversion to useful energy. This trip was taken to meet with USAID Mission staff, Indian government officials, and senior staff of the governmental, industrial, and university laboratories involved in the US-India Biomass and Coal Conversion Programs, and to define the collaborative program in preparation for the initial workshop scheduled for October 24 to November 4, 1983. The report describes the meetings of the US team members with individuals from these agencies. Prior to the meetings, project and administrative guidelines were provided by the USAID Mission. In specific areas where field trips were made, the team members were separated into two groups, the coal conversion group and the biomass conversion group. The purpose of the field trips was to discuss the scope of the proposed research, development and demonstration projects with the individual principal investigators and where demonstration projects with the individual principal investigators and where appropriate to develop work plans for implementing these projects. For each field visit, information is provided on the participants at the meetings, description of the facilities, research areas of involvement and areas of collaborative research of interest. At the end of the field trips, a consolidation session was held in New Dehli, which was attended by key participants from each of the centers visited and key Indian government officials to lend focus with regard to program priorities. In the Biomass Conversion area, considerable progress was made with regard to project definition and development of cooperative work plans.

44480 **(DOE/PE/70267—T9) Futures trading and oil market conditions.** Bohi, D.R.; Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Mar 1985. Contract AC01-80PE70267. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016785.

This paper examines how changes in oil market conditions affect the link between spot and futures prices for oil and ways in which information about market conditions may be extracted from observation of futures trading. It is found that futures prices do not perform well as simplistic predictors of spot prices. A more sophisticated model of spot and futures prices is developed that emphasizes (1) the relationship between inventory demand and price behavior, and (2) the effect of supply shocks and inventory demand shocks on market performance. Comparison of the model's results with actual behavior in the market for No. 2 Heating Oil indicates that futures market activity can be useful as a guide for understanding how a disturbance is affecting the market. 12 refs., 6 figs., 4 tabs.

44481 **(DOE/PE/70267—T10) International cooperation in tariffs and stockpiles for coping with oil supply disruptions.** Murphy, F.H.; Toman, M.A.; Weiss, H.J. (Resources for the Future, Inc., Washington, DC (USA)). Nov 1984. Contract AC01-80PE70267. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016782.

Energy and National Security Series: discussion paper D-82AA.

It is now widely recognized that the energy security policies of the industrialized oil-consuming countries are inherently interconnected through their effects on a single world market for oil. This paper quantitatively examines these interconnections, the tradeoffs between strategic oil stockpiling and import demand restraint, and the contrast between (Nash) noncooperative and cooperative outcomes, using a numerical dynamic game model that generalizes Hogan's analysis. Among the principle conclusions of our study are: (1) cooperation in stockpile management would call for stocks from 15 to 50% larger than noncooperative inventories, with more of the increment falling on non-US countries; (2) over a wide range of scenarios a "rapid release" of stocks is the optimal response to a disruption, though stockpile coordination can imply a slower (percentage) release of inventories; and (3) the use of realistic import demand restraint policies does not drastically alter optimal stockpile policies. 20 refs., 2 figs., 15 tabs.

44482 **(DOE/PE/70267—T11) Emergency demand restraint measures: a descriptive survey.** Coda, M.J. (Resources for the Future, Inc., Washington, DC (USA)). Jul 1982. Contract AC01-80PE70267. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016762.

Energy and National Security Series: discussion paper D-82G.

This report offers a catalogue of emergency demand restraint mesures; it includes all those which have received significant public attention. Estimates of oil savings from each measure are provided and a descriptive identification of possible cost and inefficiencies made. Tables are used to summarize the expected oil consumption savings resulting from the measures and, for comparative purposes, the estimated size of price increases necessary to accomplish similar reductions. While only illustrative, these shadow prices are, in many cases, surprisingly small. For example, a $0.04 per gallon price increase would achieve the same gasoline savings as a plan to reduce single-passenger commuting by forcing employers to adopt strategies such as restrictions on parking and vanpool programs. Regulations also impose administrative and enforcement costs which constitute a dead-weight loss to society. Estimates of the size of these costs have been provided when available. An important question, not addressed in this paper, is whether these costs are worth bearing in order to avoid the income distributional consequences associated with price increases. In offering suggestions for further research, the author observes that the loss of consumer satisfaction from emergency demand restraint measures is often understated because it does not take into account other costs consumers must bear (lower speed limits increase travel time) or because they fail to include the reduction in well-being when consumer choices are distorted. Unless they are integrated into the analytical process, biases and distortions will be introduced into comparisons among emergency demand restraint options and between them and the use of the price and tax system to limit demand. 7 refs., 7 tabs.

44483 **(DOE/PE/70267—T12) Oil supply disruptions and the optimal tariff in a dynamic stochastic equilibrium model.** Eckstein, Z.; Eichenbaum, M.S. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016761.

Energy and National Security Series: Discussion Paper D-82F.

This paper has investigated the welfare enhancing role of government interventions in decentralized economies which face uncertainty regarding the price of energy. The economic effects of oil price uncertainty cannot be studied effectively without a truly dynamic theory of oil markets. This paper represents an important first step in building such a theory. A simple but complete model of an oil importing economy is developed in which capital stock adjustments are costly, inventories are held for both convenience and

speculative motives, and traders' price expectations are based on all available information. These features of the model make it possible to address a number of questions about how private investment and inventory decisions are affected by oil price uncertainty. In turn, the insights derived have important implications for policies which seek to lessen the vulnerability of the economy to oil disruptions. The authors' principal conclusion is that oil price uncertainty does not in itself interfere with the ability of a market economy to achieve an efficient allocation of resources. Even with the kinds of adjustment cost and speculative behavior included in this model, the authors show that government intervention cannot improve economic welfare if international oil prices are unaffected by changes in import levels. On the other hand, if oil prices do depend on import levels, as well as external events, the authors demonstrate that government intervention is required to minimize negative impacts. 19 refs.

44484 **(DOE/PE/70267—T13) Noncooperative equilibrium for state dependent supergames.** Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Sep 1982. Contract AC01-80PE70267. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016764.

Energy and National Security Series: discussion paper D-82i.

This report advances the state of the game modeling art by analyzing a general class of dynamic games in which the actions of each participant influence both immediate and future payoff opportunities of other "players." The author first develops a set of axioms which imply that a noncooperative equilibrium (a set of individually rational and mutually consistent dynamic strategies) exists, so that the model itself is not vacuous. He then shows that cooperation, in the form of undertaking strategies which differ from noncooperative equilibrium choices, is mutually beneficial under certain conditions. While the technical analysis is directed primarily at an audience of specialists in game theory, the paper is useful in both setting out the capabilities of the theory and its limitations. An example concerning development and extraction of common property petroleum reserves illustrates the application of the model to externality situations. The analysis also forms a basis for work underway in the Energy and National Security Project on the dynamics of unilateral and coordinated international energy policymaking. 12 refs.

44485 **(DOE/PE/70267—T17) Analysis of embargoes and supply shocks in a market with a dominant seller.** Aiyagari, S.R.; Riezman, R. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016769.

This report demonstrates how the rational expectations methodology may be applied to oil exporter behavior. The authors derive intriguing results about the motivation of a dominant exporter in three specific cases: (1) when importer's demands are affected by supply uncertainty; (2) when disruptions occur among a competitive fringe of suppliers; and (3) when the dominant seller has capital invested in the importing country. While the authors abstract from many real world complexities to make their analysis tractable, they offer several thought-provoking insights and provide a solid foundation that should stimulate further research. 13 refs.

44486 **(DOE/PE/70267—T18) What causes oil price shocks.** Bohi, D.R. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016774.

Energy and National Security Series: discussion paper D-82S.

It is common, though debatable, to model the world oil market as some form of a producer cartel that administers oil prices. In this context, the central question is what motivates the cartel to change prices and output. The answer is only partially given by presuming that producers seek to optimize the stream of earnings over time. Aside from complexities introduced by differences in discount rates and objective functions across producers, there is still the question of determining what the market will bear. A simple and popular explanation is that the cartel has been guided by changes in prices in spot markets. In this report, the author casts doubt on the importance of spot market prices in determining OPEC selling prices, and indeed on the proposition that OPEC price increases are administered rather than market induced. These observations are drawn from an examination of inventory and price behavior during the after the price shock of 1979. Although an alternative explanation of the 1979 experience is advanced, the primary message of this paper is that caution is advisable in accepting prevailing interpretations of how the market works. The ready corollary of this conclusion is that policies for mitigating harm during a disruption should be robust across a range of possible formulation processes. 14 refs., 6 figs., 1 tab.

44487 **(DOE/PE/70267—T20) Using macroeconometric models to assess the effects of oil price increases and energy policies .** Bain, I.R.M.; Whiteman, C.H. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016771.

Energy and National Security Series: Discussion Paper D-82P.

The success of any energy policy depends on the way economic agents respond to government action - or inaction. This report offers a review of the literature on energy-economy interactions. Three types of models have been used to study the macroeconomic effects of the 1973-1974 and 1978-1979 oil price shocks. This trichotomy reflects the state of the art of macroeconomic modeling in general. Statistical models make it possible to summarize conceptions among variables without any theoretical preconceptions. Since such models are not derived from any theory about the behavior of economic agents, they cannot explain the correlations. Statistical models relegate all events to surprises. Economic models analyze the fit of a theory to a set of data. However, so-called conventional economic models fail to distinguish adequately between an event as a surprise, on the one hand, and as a fundamental change in the environment in which economic agents operate on the other. This failure hampers the ability of these models to interpret events, and even more so, to predict future outcomes. The third category comprises models which are a hybrid of statistical and economic models: they incorporate behavioral relationships derived from economic theory which are sensitive to whether an event is interpreted as a surprise or a fundamental change in the economic environment. In principle such models meet the objections noted above.

44488 **(DOE/PE/70267—T21) Impact of oil market disruptions on other fuel prices.** Lareau, T.J. (Resources for the Future, Inc., Washington, DC (USA)). Feb 1982. Contract AC01-80PE70267. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016759.

During serious oil supply disruption episodes, other fuels rose in price along with oil, though not as steeply. Their increases contributed to depressed demand for other commodities, raised consumer and producer price indices, and undoubtedly intensified the pressures on macroeconomic and monetary policy. This report analyzes the pattern of fuel prices over the last ten years and concentrates on the factors that led to a price realignment subsequent to the previous oil disruptions. Based on this analysis and on past and prospective developments, the author concludes that natural gas and coal prices will be less affected by future oil price changes than in past episodes. He estimates that the nonoil fuels would contribute less than one-half a percentage point to either the PPI or CPI in the event of a moderate-sized disruption in which oil prices increased 75% in real terms. The author finds this relatively small expected price impact through his analysis of the markets for these fuels. The evidence suggests that the recent independence of the coal and oil markets will continue. In contrast, the short-run supply of natural gas is highly inelastic, and opportunities exist for almost immediate replacement of oil with gas as relative prices change. Thus, the price change of natural gas is principally determined by how much substitution would take place in a disruption. The effect of an oil disruption on the price of natural gas will depend on the timing and duration of any future disruption. This paper places boundaries around the likely nonoil price effects of a disruption under current and prospective conditions, and thus provides important information for policy planners. It clarifies the effect of prospective developments on those boundaries. Finally, it offers analysts a framework with which the effects of a disruption can be es-

timated under conditions existing when it occurs. 37 refs., 6 figs., 6 tabs.

44489 (DOE/PE/70267—T22) Dynamic Nash game model of oil market disruptions and strategic stockpiling. Murphy, F.H.; Toman, M.A.; Weiss, H.J. (Resources for the Future, Inc., Washington, DC (USA)). Nov 1984. Contract AC01-80PE70267. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016783.

Discussion paper D-82BB.

In this paper we present and analyze a Nash dynamic game model for invstigating public and private-sector oil inventory policies in unstable world oil markets. Conceptual results about the model include simple, verifiable conditions for uniqueness and stability of solutions, along with characterizations of optimal policies. We also present results and discuss computational issues that arise in determining "subgame perfect" infinite-horizon equilibria, using a steady-state policy iteration approach. 15 refs., 2 figs.

44490 (DOE/PE/70267—T23) Policy responses to oil disruption risks: an analytical overview . Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Aug 1984. Contract AC01-80PE70267. 96p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016781.

Energy and National Security Series: Discussion Paper D-82Z.

This paper examines the state of the art in policy analysis of oil security issues. Throughout the paper, emphasis is placed on private sector responses to oil disruption risks, the implications of these responses for effective public policy, and the distinction between market failures which give rise to a role for government intervention and unavoidable disruption costs. Specific topics addressed in the paper include recent developments in the analysis of US stockpile policy, the implications of macroeconomic disruption costs for stockpile and tariff policy, and the international dimensions of oil security issues. 68 refs., 4 figs.

44491 (DOE/PE/70267—T24) Risk analysis of the Strategic Petroleum Reserve: theory and preliminary estimates. Bouhdili, C.; Montgomery, W.D. (Resources for the Future, Inc., Washington, DC (USA)). Jun 1983. Contract AC01-80PE70267. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016776.

Energy and National Security Series: Discussion Paper D-82U.

This paper describes how modern developments in the analysis of risks associated with public investment can be applied to questions of the desirability and optimal size of a Strategic Petroleum Reserve (SPR). Some preliminary quantitative results and directions for further research to refine the results are presented. It is assumed throughout that investment in an SPR is a proper function of government because of social costs and benefits of oil inventory management that are not included in private calculations of profit and loss. In this paper we assume that world oil prices, in normal and disrupted periods, depend on the level of US oil imports; that to make possible releases designed to hold down prices during a disruption, stocks during normal periods must be larger than the levels private traders will hold; and that the requisite additional stocks are acquired through direct government purchase for an SPR. A simple two-period framework, stockpile policy is described that is optimal in terms of expected value maximization. This is the standard framework for analysis of optimal stockpile size and involves ignoring issues of attitude toward risk. The opposite extreme of what might be called the price diversification benefits of the SPR is analyzed. It is assumed that the level of stocks has no influence on oil prices and evaluates the risk premium associated with stocks of any given size. These two perspectives are considered jointly and the optimal size of the SPR is examined, given both risk attributes and price effects. 14 refs., 4 tabs.

44492 (DOE/PE/70267—T27) Review and analysis of oil import premium estimates. Broadman, H.G. (Resources for the Future, Inc., Washington, DC (USA)). Dec 1981. Contract AC01-80PE70267;AC02-76CH00016. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016758.

Energy and National Security Series: discussion paper D-82C.

This report explores efforts to estimate the oil import premium. Starting from a careful conceptual formulation, the author reports on and evaluates the findings obtained by others. His aim is to determine if the band of uncertainty around the value of the premium can be narrowed. He shows the estimates to be highly sensitive to several assumptions. Unfortunately, little is known about the reasonableness of these assumptions. Moreover, flaws in some of the studies cast further doubt on the conclusions they reach about the level of the premium and its implications for policy. Caution is suggested in moving very quickly very far in implementing policies based on oil import premium estimates found in the literature. The state of the art can be improved, and in highlighting the weaknesses in the existing literature this paper suggests where research resources might best be deployed in the future. The elements making up the premium are pretty well understood, as is the process by which the premium can be estimated once assumptions are made. The problem arises from the reliability of the input assumptions themselves. For example, there is no assurance that the formulation of the response of oil exports to import reduction actions captures the way the oil market would work out in the end. Some of the behavioral and structural uncertainties that prove critical to oil premium estimation also turn out to be on the frontier of modern economics: how do price shocks affect the macro economy; how do expectations affect private agents' behavior; and how might that latter process be modeled and then taken into account in designing policies. 3 figs., 2 tabs.

44493 (DOE/PE/70267—T28) Implications of macroeconomic disruption costs and public-private interactions for strategic oil stockpiling. Murphy, F.H.; Toman, M.A.; Weiss, H.J. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1985. Contract AC01-80PE70267. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016784.

Energy and National Security Series: discussion paper D-82CC.

In this paper we present a unified treatment of public-private interactions in oil stockpiling with oil import tariffs which takes into account both the balance-of-payments cost and macroeconomic dislocations from oil supply disruptions. The analysis is based on a stochastic, dynamic, nonlinear simulation model that computes "intertemporally credible" Nash equilibria for the public-private stockpile game under a variety of input assumptions. Two key policy implications of the study are: (1) with no tariff policy, the United States should be prepared to rapidly draw down the SPR even in a fairly moderate crisis, despite the resulting "crowding out" of private stocks; (2) however, there are significant social gains from imposing a tariff of around $10/bbl under nondisrupted market conditions (with the tariff to be scaled back or eliminated in a crisis), together with a more conservative strategy for drawing down the SPR. In addition to shedding light on these policy issues, the paper illustrates a methodology which may be useful for analyzing a number of other dynamic games. 28 refs., 6 figs., 12 tabs.

44494 (DOE/PE/70267—T31) Tariffs and the economic costs of an oil disruption. Bohi, D.R.; Montgomery, W.D. (Resources for the Future, Inc., Washington, DC (USA)). Dec 1981. Contract AC01-80PE70267;AC02-76CH00016. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016757.

Energy and National Security Series: discussion paper D-82B.

The questions addressed are should the government impose a tariff that would lessen the harmful effects of future oil supply disruptions and if so, given the early and continuing cost of preparations, are these measures worth taking. Developing a position on these and related questions requires understanding the characteristics of the economic costs imposed by a disruption. Two features of these costs are examined. First, are the costs in some degree avoidable or are they inevitable consequences of the shutting off of oil supplies. Second, can the private sector anticipate the costs of disruption and avoid them efficiently without government action. With clear insights into these issues the analyst can begin to consider alternative policies and their implications. This report looks carefully at some widely held views about the effect of the level of oil imports on the economic vulnerability of the US to oil import dis-

ruptions. By focusing on the tariff, the economic instrument best adapted to lowering imports, core issues are exposed. 3 figs.

44495 **(DOE/PE/70267—T33) Benefits of International Energy Cooperation: a theoretical perspective.** Toman, M.A. (Resources for the Future, Inc., Washington, DC (USA)). Aug 1982. Contract AC01-80PE70267. 58p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016763.

Energy and National Security Series: discussion paper D-82H.

The question addressed is do international agreements, such as IEA agreements, lessen the effects of oil supply disruptions through policy coordination. Specifically, the author shows that coordinated increases in import tariffs or oil stockpiles can increase the well-being of oil consuming countries relative to a situation with no cooperation. (The theory can extend further: coordination among consuming and exporting countries also can be mutually beneficial. Consuming countries can avoid the costs of security measures and exporting countries the adverse consequences of such policies on their oil revenues.) In setting out the formal conditions for gain, the author provides a foundation for further work, now planned at RFF, that will assess the IEA framework through examination of those behavioral elements for which incentives to cheat are greatest. Three important caveats surface in this analysis. First, to achieve significant benefits, cooperation among most of the major importers may be needed; partial coverage may not work. Second, the level of coordination required for optimal outcomes demands substantial policy flexibility among coordinating countries; thus, proposals which look attractive on paper may not be viable in practive. Finally, coordination policies are not costless. While the paper does not address such costs directly, assuring compliance and resolving conflicts among national interests will absorb substantial diplomatic effort and could strain national political structures. Together with an assessment of these costs, then, this paper provides a foundation for a deeper understanding of international institutions such as IEA, a tool for investigating the possible need for changes in institutional arrangements, and a set of guideposts in formulating such arrangements so as to minimize the centrifugal forces that will tend to destroy them when stress occurs. 12 refs.

44496 **(DOE/PE/70267—T38) Energy: the international dimension.** Russell, M. (Resources for the Future, Inc., Washington, DC (USA)). Mar 1983. Contract AC01-80PE70267. 42p. Resources for the Future, Inc., 1755 Massachusetts Ave., NW, Washington, DC 20036. File Number TI85016754.

This report assesses the extent to which oil markets freed of price and allocation controls can and will be successful and to what extent intervention may be desirable. Addressed are the redistribution of wealth resulting from price increases, the effect of those increases on economic activity and prospective economic growth, and the change in the prospective patterns of energy services and uses that have followed. The main source of tension in the market which was identified was the threat posed by uncertain oil. The author concludes that energy did not pose a single crisis which passed with the 1970's, but a series of challenges that remain today and beyond. 2 figs., 3 tabs.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 44917

2960 Electric Power

REFER ALSO TO CITATION(S) 44018, 44445, 44463, 44561

44497 **(DOE/BP—418) Operations and maintenance: a performance review and staffing study.** (USDOE Bonneville Power Administration, Portland, OR). 1982. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017296.

This booklet contains two separate reviews of performance and productivity. One review was undertaken by the Bonneville Power Administration's Operations Division; the other, by the agency's Maintenance Division. Both reports stem from in-depth investigations into program procedures and staffing principles. Both focus on increasing efficiencies in agency programs, in ways that will not appreciably reduce the reliability or performance of BPA's critically important transmission system.

44498 **(DOE/BP—506) 1985 wholesale power rate schedules and general rate schedule provisions.** (USDOE Bonneville Power Administration, Portland, OR). Jul 1985. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016100.

Bonneville Power Administration's 1985 Wholesale Power Rate Schedules and General Rate Schedule Provisions, contained herein, were approved on an interim basis effective July 1, 1985. These rate schedules and provisions were approved by the Federal Energy Regulatory Commission, United States Department of Energy, in a Commission Order issued June 28, 1985 (Docket No. EF85-2011-000). These rate schedules and provisions supersede in their entirety the Administration's Wholesale Power Rate Schedules and General Rate Schedule Provisions effective November 1, 1983.

44499 **(DOE/BP—507) 1985 transmission rate schedules and general transmission rate schedule provisions.** (USDOE Bonneville Power Administration, Portland, OR). Jul 1985. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016101.

Bonneville Power Administration's 1985 Transmission Rate Schedules and General Transmission Rate Schedule Provisions, contained herein, were approved on an interim basis by the Federal Energy Regulatory Commission, United States Department of Energy, in a commission order issued June 28, 1985 (Docket Nos. EF-852021-000, et al.) These rate schedules and provisions became effective July 1, 1985. Unless otherwise specified in the Agreement, these rate schedules and provisions supersede the Administration's Transmission Rate Schedules and General Transmission Rate Schedule Provisions effective February 1, 1984.

44500 **(DOE/EIA—0470) Analysis of the projected electricity prices to 1995.** Sanders, R. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Aug 1985. 67p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE85016545.

This study is designed to supplement the energy price projections and discussion presented in the Annual Energy Outlook, 1984. This report provides additional analysis of the projections of electricity prices through 1995, examines the factors expected to influence future electricity prices, and presents a range of electricity price forecasts based on the likely impacts of these factors.

44501 **(DOE/EIA—0472) Fuel choice in steam electric generation: historical overview.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Aug 1985. 163p. NTIS, PC A08/MF A01 - GPO; GPO Dep. File Number DE85016902.

This report presents data on utility fuel use for generation for the short term, which includes both the choice of fuel for multifuel boilers and the mix of different generators in use at a given time. Fuel choice for the short term may also include the purchase of power. Fuel use on a monthly basis is reviewed for each of 12 regions. The regions are based on the regional reliability councils (and certain subcouncils) of the North American Electric Reliability Council (NERC). The subregions used in this study allow concentration on specific areas that have special fuel-use characteristics. Fossil-fuel steam generation produced 73 percent of the electricity generated in the contiguous United States in 1984, nuclear generation 14 percent, and hydroelectric generation virtually all the rest. Annual net generation and percent of total generation are shown by energy source, respectively, for the United States during the period from 1970 through 1984. The scale of the vertical axis differs on each graph, which should be noted when comparing the amounts of generation for each graph, which should be large share of electricity generation from fossil fuels and the capability of some boilers to switch from one fossil fuel to another, this report focuses on fossil-fuel choice. 26 figs., 66 tabs.

44502 **(DOE/EIA—0474(85)) Annual Outlook for US Electric Power, 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 12 Aug 1985. 78p. NTIS, PC A05/MF A01 - GPO; GPO Dep. File Number DE85016937.

This report provides a history and projections of US electric utility markets. It includes summary information on the production of electricity, its distribution to end-use sectors, and on electricity, its distribution to end-use sectors, and on electricity costs and prices. Further, this publication describes the ownership structure of the industry and the operations of utility systems and outlines basic electricity generating technologies. The historical information covers the period from 1882 through 1984, while projections extend from 1985 through 1995. 9 figs., 8 tabs.

44503 **(EPRI-EA—4079-CCM) Utility fuel inventory model: Version 1.0.** Morris, P.A.; Sandling, M.J.; Fancher, R.B.; Kohn, M.A. (Applied Decision Analysis, Inc., Menlo Park, CA (USA); Decision Focus, Inc., Los Altos, CA (USA)). Aug 1985. 261p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920849.

The Utility Fuel Inventory Model is a tool intended to help power companies develop reasonable, low-cost fuel inventory policies. The principal goal of inventory management is to balance the cost of building and maintaining fuel reserves against the risk of running out of fuel. The Utility Fuel Inventory Model uses analytic techniques to provide utilities with insights about how to strike this balance. The purpose of this User's Guide is to discuss the general nature of the inventory problem, to describe the Utility Fuel Inventory Model, and to instruct interested planners and decision makers in its use. Included are descriptions of the model input and output sets, as well as sample applications of the model.

44504 **(EPRI-EA—4205) Estimating response to time-of-use rates: implications of the homothetic separability assumption. Final report.** Parks, R.W. (Parks (Richard W.), Seattle, WA (USA)). Aug 1985. 48p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920837.

Making certain structural assumptions in models of electricity demand by time of use helps utility analysts examine household responses to different rate structures. As this study found, well-chosen assumptions can provide precise data and easily interpreted results. Oversimplified, however, they can result in biased parameter estimates.

44505 **(EPRI-EM—4174) Value of competitive model testing in the bid evaluation process for hydroelectric turbomachinery. Final report.** Boyd, D.W.; Roughgarden, J.D. (Decision Focus, Inc., Los Altos, CA (USA)). Jul 1985. 92p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920841.

This report compares two ways of selecting hydro equipment vendors. The first is the traditional process used in the United States. It entails ranking the vendors and making the contract award based solely on the information contained in the competitors' proposals. The second selection process is more common in Europe. Again, it first entails an initial ranking of vendors based on their proposals. But then two or more of the leading vendors are invited to develop scaled hydraulic models of their designs to be tested at an independent facility. The final contract award is then made based on the information from both the proposals and the test results. With competitive model testing, the vendor selection decision is made with more information. However, this additional information is expensive. The central question is whether its value exceeds its cost. This report concludes that for new or upgraded plants having a net present value greater than $10M, the contribution of competitive model testing toward improving designs and helping to identify the best vendor will typically increase the nominal project value by 4 to 10%.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 44549

44506 **(DOE/EIA—0354(83)) State Energy Overview 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 20 Aug 1985. 458p. NTIS, PC A20/MF A01; 1 - GPO; GPO Dep. File Number DE85017299.

Selected energy data, primarily for the year 1983, are reported for the United States, each of the 50 states, and the District of Columbia. Shown are energy production and consumption by type, expenditures for and prices of individual energy types, energy inputs at electric utilities, energy reserves, and value of energy production. Also included are certain demographic data (such as population and income) and energy-related data (such as heating and cooling degree-days and vehicle-miles traveled). A glossary and a discussion of the methodology and sources of data are provided. 588 figs., 157 tabs.

44507 **(NP—5752501) Energy consumption in the primary agricultural sector in 1982/1983. The present situation and prospects.** Parsby, M.; Fog, M.M. (Statens Jordbrugsoekonomiske Inst., Valby (Denmark)). 1984. 94p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752501.

EFP-84.

In this report consumption in the primary agricultural sector, comprising agriculture, horticulture and forestry, is estimated for 1982/83. Direct consumption comprises energy in the form of diesel oil, electricity and fuel gas oil used on farms. Indirect consumption comprises use of energy outside agriculture to produce production factors such as fertilizers, imported feedstuffs, buildings, etc. used in agriculture. The direct energy consumption in 1982/83 adds up to approx. 40 PJ or 5.6 per cent of the total domestic energy consumption. In 1974/75 direct energy consumption was 48 PJ or 6.8 per cent of the total domestic energy consumption. The decrease in direct energy consumption is mainly due to a considerable fall in energy consumption in greenhouses. The main part of the increase in indirect energy consumption in agriculture is due to an increase in the energy value of imported feedstuffs from 21 PJ to 32 PJ. This includes transportation, grain-drying and feedstuff preparation. The use of energy for production of domestic feedstuffs outside agriculture is estimated to have fallen by 25 per cent. The ratio between the volume of production and energy consumption has increased considerably, in particular for horticultural production and crop production, whereas animal production has become more energy demanding. Possible areas of energy saving are: the area of greenhouse heating, drying of feed grain, reduction of the consumption of nitrogenfertilizers and increased control, better maintenance of tractors and correct adjustment between tractors and tools. The present report has focused on a number of measures which could lead to saving of energy in agriculture.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 43931, 43933, 43935, 43945, 43952, 44018, 44083, 44131, 44479

30 DIRECT ENERGY CONVERSION

44508 **Direct Energy Conversion: a current awareness bulletin.** Kinser, W.H. (ed.). *Direct Energy Conversion;* No. 85/1, vp(15 Jan 1985). (PB—85-946601; DOE/DEC—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

This current awareness bulletin announces on a semimonthly basis the current worldwide information entered into the Energy Data Base on all aspects of direct energy conversion. Categories include photovoltaic conversion, magnetohydrodynamic generators, electrohydrodynamic generators, thermoelectric generators, thermionic converters, fuel cells, and miscellaneous converters. An abstract is incliuded with each citation. (WHK)

3001 Mhd Generators

REFER ALSO TO CITATION(S) 44508

44509 (DOE/CH/10018—T1) Seed regeneration processes for coal fired MHD power plants. Krumreich, B.M. (Babcock and Wilcox Co., Barberton, OH (USA)). 7 May 1985. Contract AC02-79CH10018. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85015501.

Potassium carbonate seed is used to produce an electrically conducting gas required to generate electrical power in the open cycle coal fired MHD system. The seed can also serve to capture the sulfur released by the coal during combustion. Due to the high cost of the seed material, a large portion of the seed must be recycled for the MHD system to be economically feasible. Compiled information on the following processes for seed regeneration is presented: PERC; Formate; Modified Engel Precht; Econoseed; Aqueous Carbonate; Modified Tampella; and Westinghouse. In addition, a seed recycle system using a scrubber for flue gas desulfurization was studied.

44510 (DOE/OR/21400—T170) Study of alkali- and sulfur-enhanced corrosion of advanced energy systems. Final report. Stinespring, C.; Annen, K.; Stewart, G. (Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics). Jan 1984. Contract AC05-84OR21400. 50p. (ARI/CCEP—47953-01). NTIS, PC A03/MF A01; GPO Dep. File Number DE85016180.

The initial stage of MHD anode corrosion process appears to be dominated by out-diffusion of metallic species into the powder deposit. In addition, K and S appear to diffuse into the native oxide and underlying metal substrate. The out-diffusion process clearly leads to a loss of metal species from either the native oxide or metal substrate, while in-diffusion leads to the formation of sulfides and possibly to the accumulation of K containing compounds which may ultimately flux the protective oxide scale. The results for MHD anodes may be compared with those from previous studies of alkali-sulfur enhanced corrosion of turbine alloys. Although the specific details of these studies differ, both agree that rapid or catastrophic corrosion is preceded by a variable length induction period. During this period, relatively small changes in weight are observed. However, the protective metal oxide scale is breached which establishes the condition for rapid direct attack by condensed corrosive deposits. Thus, the mechanisms and kinetics of processes associated with the induction period are of great interest in understanding the survivability of various alloys. In the corrosion modeling effort, it was found that a simple model which considered only the diffusion-limited corrosion of iron did not correctly predict the iron corrosion product species for iron-based alloys. This lack of agreement was due to the absence of the treatment of other metal constituents in the alloy which form corrosion products. A more detailed model which includes equilibrium and diffusion relations for all metal species is required for accurate modeling of the corrosion product composition. 14 refs.

44511 (DOE/PC/70509—T1) Magnetohydrodynamic power generation. Quarterly report, September 1-December 31, 1984. Kruger, C.H.; Eustis, R.H.; Mitchner, M; Self, S.A. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Dec 1984. Contract AC22-84PC70509. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015411.

The research program consists of the following topics: Boundary layers and generator loss mechanisms: (More specifically, this research concerns the nature and effects of MHD-induced secondary flow, i.e., the circulation of gas over the channel cross-plane); Plasma nonuniformities and instabilities: (More specifically, this work is aimed at the measurement of changes in the acoustic velocities by MHD effects. These effects are intimately tied to the questions of possible instabilities in large-scale MHD generators.); Investigation of rod electrodes: (Rod electrodes should produce a more uniform current distribution and thereby may permit operation at higher Hall fields.); Seed-slag interaction and the reactivity of coal: (The question of the magnitude of potassium vapor loss owing to absorption by coal slag is an important factor in the economics of MHD generator operation. Also of importance is the attainment of complete energy release from pulverized coal particles in short times, to minimize heat loss and maximize electrical conductivity.); and Disk generators: (The disk geometry offers several advantages over linear channels, such as the simplicity of the electrode configuration and the magnet system.).

44512 (DOE/PC/70509—T2) Magnetohydrodynamic power generation. Quarterly report, March 1-May 31, 1984. Eustis, R.H.; Kruger, C.H.; Mitchner, M.; Self, S.A. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Jun 1984. Contract AC22-84PC70509. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015412.

Secondary flow driven by Lorentz forces in an MHD channel has recently been the subject of considerable interest. Several theoretical studies have indicated that secondary flow may be a significant factor in generator performance. Recently we have performed direct measurements of the secondary flow field over a downstream cross-plane of the M-2 channel. The velocity measurements were performed using laser Doppler anemometry. The channel was connected in the Hall configuration, with an electrode pair at the upstream end connected to a pair at the downstream end; net Hall current was controlled by means of an external power supply. Numerous measurements of the y-directed velocity component were made over a grid covering one quadrant of the cross-plane, and under four sets of boundary conditions. Transverse rod electrodes have the potential of improving aspects of the electrical performance of linear open cycle MHD generators. Previous experimental measurements in the M-2 generator have shown that current is distributed more uniformly on a rod electrode than on a conventional flat electrode flush to the generator wall. This is especially important at high Hall parameters for which current concentrates strongly at flat electrode edges. The combined rod electrode characteristics of a more uniform current distribution and the geometric advantage of electrode contact with the interelectrode insulator only along the generator sidewall, should make a rod electrode generator more resistant to insulator-initiated Hall field breakdown. In addition, an increased resistance to axial field breakdown may allow an increase in electrode pitch, and hence a reduction in the complexity of segmented Faraday generator construction as well as a reduction in electrode heat loss.

44513 (DOE-tr—273-Vol.3) Eighth international conference on MHD electrical power generation. Volume 3. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). 1983. 326p. (CONF-830906—Vol.3-Trans.; OLS—84-115-Vol.3). NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85013333.

From 8. international conference on MHD electrical power generation; Moscow, USSR (12 Sep 1983).

The VIIIth International Conference on MHD Electrical Power Generation was convened at the initiative of the International Liaison Group on MHD Electrical Power Generation by the USSR Academy of Sciences (Institute of High Temperatures) and under the sponsorship of: UNESCO; Council for Mutual Economic Assistance (COMECON); Energoinvest (Yugoslavia); Control Data Corporation (USA); and the Bhabha Atomic Research Centre (India). Considerable emphasis is placed in the Conference proceedings on the problems of testing, designing and mathematical modeling of MHD channels, as well as on the studies into MHD flows, heat transfer, properties and physical processes in plasma, electrode phenomena and diagnostics. The various MHD components are described from the standpoint of their development, namely, compressors, air preheaters, systems for seed injection and recovery, combustors, cooling systems, steam generators, superconducting magnets, loading systems etc. Problems related to high-temperature materials, operation of the equipment under conditions of slagging, and suppression of nitrogen and sulfur oxides are discussed. All but one of the papers have been entered into EDB; one had been entered previously from other sources.

44514 (DOE-tr—273-Vol.4) Eighth international conference on MHD electrical power generation. Volume 4. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). 1983. 312p. (CONF-830906—Vol.4-Trans.; OLS—84-115-Vol.4). NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85012783.

From 8. international conference on MHD electrical power generation; Moscow, USSR (12 Sep 1983).

The VIIIth International Conference on MHD Electrical Power Generation was convened at the initiative of the International Liaison Group on MHD Electrical Power Generation by the USSR Academy of Sciences (Institute of High Temperature) and under the sponsorship of: UNESCO; Council for Mutual Economic Assistance (COMECON); Energoinvest (Yugoslavia), Control Data Corporation (USA); and Bhabha Atomic Research Centre (India). The proceedings of the VIIIth International Conference on MHD Electrical Power Generation contain the results of most recent R and D work aimed at practical realization of this advanced method of electrical power generation. The papers presented to the Conference deal with heat-generating schemes and cycles, conceptual and detail designs of MHD power plants, including that of the first commercial 500-MW power generating unit presently under construction in the USSR. Research results obtained in pilot and experimental facilities in the USSR, USA, Poland, Japan, Netherlands and other countries are described. Volume 4 was concerned with Materials, Combined-Cycle, Liquid-Metal MHD, and Closed-Cycle Disk-Type MHD Generator. This DOE report contains full translations in English of all the papers in Volume 4. These have been entered individually into EDB and ERA. (LTN)

44515 **(INIS-mf—9745) Gasdynamic performance in relation to the power extraction of an MHD generator.** Massee, P. (Technische Hogeschool Eindhoven (Netherlands)). 23 Dec 1983. 160p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781547.

Includes Dutch summary; 94 refs.; 51 refs.; 5 tabs.

A study of the gasdynamical processes in MHD generators has been made both theoretically and experimentally. A core flow and boundary layer model has been developed. In order to obtain a fast computer code which can be used for engineering purposes the quasi-one-dimensional approximation is used. It is shown in this thesis that the boundary layers have to be calculated from integral equations describing momentum, kinetic energy and stagnation enthalpy respectively, when the MHD effects in the boundary layers are properly taken into account. Calculations with the developed core flow and boundary layer model have shown that the electrical power output is limited by the design of the existing facility and have indicated possibilities to circumvent this limitation.

3002 Ehd Generators

REFER ALSO TO CITATION(S) 44508

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 44508

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 44508

3005 Fuel Cells

REFER ALSO TO CITATION(S) 44508, 44670

44516 **(DOE/MC/20212—1877) Effects of H_2S on molten carbonate fuel cells. Progress report, October 1-December 31, 1984.** Remick, R.J. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1985. Contract AC21-83MC20212. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016161.

This report is a description of work accomplished at the Institute of Gas Technology during the sixth quarterly reporting period from October 1 through December 31, 1984. The overall program objective is to identify the poisoning mechanisms responsible for performance losses observed in molten carbonate fuel cells (MCFC) operating on sulfur-containing gases. The anticipated product from the overall program is a performance model capable of predicting fuel cell performance on a variety of fuels containing trace sulfur contaminants at the parts per million level. This model should aid in arriving at a justifiable specification for sulfur cleanup requirements for MCFC power plants. Work addressed four separate aspects of the sulfur contamination problem. In one bench-scale experiment, IGT-84-D, the impact of 5 ppM of hydrogen sulfide in the fuel upon MCFC performance was investigated at temperatures of 600°, 650°, and 700°C. Of these three, the impact was most severe at the lowest temperature. Previous work with laboratory scale cells (3-cm^2 electrodes) suggested that the performance degradation caused by hydrogen sulfide was lessened as the temperature was increased and disappeared entirely at 700°C. This proved not to be the case in the bench-scale (94-cm^2 electrodes) experiments. Although the impact of hydrogen sulfide was less at 700°C than at 650°C, there was, nevertheless, a measurable performance loss noted when hydrogen sulfide contaminants were added to the fuel. Also accomplished during this quarter was the completion of an 1800 hour bench-scale test started in the fifth quarter. This experiment was designed to evaluate the impact of sulfur dioxide in the oxidant gases upon fuel cell performance.

44517 **(EPRI-EM—4179) Parameteric analysis of a 6500-Btu/kWh heat rate dispersed generator. Final report.** Patel, P.S. (Energy Research Corp., Danbury, CT (USA)). Aug 1985. 116p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920807.

Cost and performance assessments of two alternative system designs for a 2-MW molten carbonate fuel cell power plant yielded encouraging results: a 6500-Btu/kWh heat rate and a total plant investment of $1200-$1300/kW. Differences between the two designs establish a permissible range of operating conditions for the fuel cell that will help guide its development.

44518 **(PB—85-220648/XAB) Evaluation of natural-gas molten-carbonate power plants. Final technical report, January 11, 1982-October 31, 1984.** Meyer, A.P. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jan 1985. 109p. (FCR—5196). NTIS, PC A06/MF A01.

The use of natural-gas molten-carbonate power plants in industrial cogeneration applications has been shown to significantly reduce energy cost, expand industrial use of gas, and reduce oil imports. Of the concepts evaluated, those based upon improved integration of the fuel-cell stack and fuel processor provided the highest potential. To realize this improved potential, work would be required to achieve cell performance, endurance and cost goals, and integration levels not yet reached. The objective of this program was to investigate, define, and demonstrate solutions to the endurance-limiting phenomena in molten-carbonate fuel cells, and to investigate by test the key issues of improved integration of the molten-carbonate fuel-cell stack and a natural-gas fuel processor. The primary mechanism of performance loss of molten carbonate fuel cells was found to be electrochemical reactions that result in the loss of electrolyte through the wet seals. A control of these reactions and a modified design were calculated to be capable of drastically reducing decay. Experimental bench-scale cell performance was obtained over a range of fuel compositions and pressures resulting in the optimization of system conditions which result in minimum cost of electricity for the sensible-heat reforming power plant.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

44519 **Buildings Energy Conservation: a current awareness bulletin.** Raridon, M.H.; Smith, L. (eds.). *Buildings Energy Conservation;* No. 85/3, vp(15 Feb 1985). (PB—85-900703; DOE/BEC—85/3).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

This bulletin announces on a semimonthly basis the worldwide information available on the technology required for economic energy conservation in buildings and communities. Information is included on the following: general, residential, office, school, municipal, public, commercial, and industrial buildings; municipalities and community systems including conservation services and public utilities; and energy conservation education and public relations.

3201 Buildings

REFER ALSO TO CITATION(S) 44031, 44033, 44034, 44035, 44036, 44037, 44038, 44039, 44040, 44041, 44042, 44043, 44044, 44045, 44046, 44047, 44048, 44049, 44050, 44051, 44052, 44053, 44054, 44055, 44056, 44059, 44060, 44079, 44470, 44926, 45119

44520 (AD-A—154651/4/XAB) Evaluation of a commercially available single building EMCS (energy monitoring control system). Final report, October 1981-September 1984. Sanchez, I.; Franchi, J.; Canfield, K. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Feb 1985. 32p. (NCEL-TR—914). NTIS, PC A03/MF A01.

The Navy is investigating new ways to reduce energy consumption at Naval bases throughout the world. At the Naval Weapons Center, China Lake, Calif., 75% energy savings were achieved at the Thompson Laboratory by installing a commercially available single-building energy-monitoring control system (SBEMCS). Part of these savings was the result of identifying other problem areas during the installation such as broken ducting in the attic, stuck dampers, and faulty thermostats. The enormous savings realized after the installation of the SBEMCS resulted in a payback period of 6 months. Prior to this installation, the air-handler units ran 24 hours a day, 365 days a year while the boiler and chiller ran continuously during their seasonal operation. It took the coordinated efforts of four people (two public works engineers from the NWC and an engineer and a technician from NCEL) to install and program the SBEMCS. The installation of this system took less than 2 weeks and energy savings started immediately. This report documents the installation and evaluation of the SBEMCS installed at the Thompson Laboratory.

44521 (AD-A—154909/6/XAB) Field and wind-tunnel testing on natural-ventilation cooling effects on three Navy buildings. Final report, October 1982-September 1983. Ashley, S.K. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Dec 1984. 166p. (NCEL-TR—912). NTIS, PC A08/MF A01.

Natural ventilation can reduce cooling loads and increase human comfort in buildings in hot, humid climates. Airflow rates are determined by wind pressure on the faces of buildings and the size of open areas. Wind pressures are calculated from the windspeed and the pressure coefficient. This report presents measurements of pressure coefficients of three buildings located at the Marine Corps Air Station at Kaneohe Bay, Oahu, Hawaii, and of wind-tunnel model tests, and comparisons of the field tests, model tests, and existing data. This report establishes the validity of the NCEL computer model as an engineering tool to predict comfort levels within a building cooled by natural ventilation, and initiates a data base of wind pressure coefficients for a variety of building forms.

44522 (AD-A—155083/9/XAB) Measuring thermal performance of building envelopes: nine case studies. Flanders, S.N. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Mar 1985. 42p. (CRREL—85-7). NTIS, PC A03/MF A01.

Nine buildings at Ft. Devens were the object of a study employing heat-flux sensors, thermocouples, a computer-controlled data-acquisition system, and infrared thermography. The purpose was to measure the R-values of those buildings to determine their economic potential for improved insulation. The sample included four frame buildings, two masonry buildings, and three frame buildings with brick facing. The technique for measuring R-values proved repeatable and accurate within 15%. Sampling a small representative sample sufficiently characterizes the entire stock of buildings. Measurement is more important for poorly insulated buildings, since the beginning R-value has a drastic impact on the budget for a cost-effective reinsulation project. At Ft. Devens, installing an external Styrofoam insulation system on concrete block barracks has a savings-to-investment ratio of about 1.4.

44523 (CONF-801197—, pp 41-44) Earth: sheltered home. Stengel, J. (Logan County Farm Bureau, Paris, AR). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

This project involves a unique earth-sheltered home. Earth is bermed around the north, east and west sides. However, instead of an earth covering over the roof, an insulated metal building has been placed above the main living area. The building will serve as a recreation area and a two-car garage. It will also reduce the chance of water leakage through the roof of the main house.

44524 (CONF-830213—3) Methods to improve the operating coefficient of performance of heat pump water heaters. Stipanuk, D.M.; Ludington, D.C. (Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Engineering). 1983. Contract FG42-81R205321. 10p. NTIS, PC A02. File Number DE85016324.

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

There are many factors which impact on the operational coefficient of performance of HPWHs. The Energy Factor values derived from the NBS/GAMA tests are not necessarily indicative of field performance. There are additional factors which impact on performance that need to be addressed. Two of these factors are discussed; temperature of inlet water to the heat exchanger (condensers) of heat pump and augmenting the temperature of the energy source. Inlet water temperature to HPWH is believed to be influenced by the water connections between the HPWH and the storage tank, the capacity of the tank with respect o the daily water usage and the control theory employed for the HPWH unit. System designs which promote and optimize batch mode of operation will result in the most efficient operation. Location of tank water connections with add-on HPWH, flow rates (velocity) of circulation water and draw-off, use of baffles and diffusers, size of tank with respect to usage, water flow control valves and electrical controls which restrict operation of HPWH all should be considered. HPWHs are perhaps least efficient when making up standby losses because of the high values of Tii. Small well-insulated tanks should be encouraged. Augmenting the temperature of the entry source, in this case air, with solar energy is discussed. With proper installation, significant gains in operational performance and savings can be achieved by operating a HPWH in a sunspace. 8 refs., 5 tabs.

44525 (CONF-850606—12) Estimation of reference or balance point temperatures. MacDonald, J.M.; Jung, L.; Tevepaugh, J.A. (Oak Ridge National Lab., TN (USA); Lockheed Missiles and Space Co., Huntsville, AL (USA)). 1985. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016406.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

For many years the enrgy performance of buildings has been estimated by using regression techniques involving energy use and heating degree day data. Recently, some techniques have emerged that use variable-base heating degree day data to more closely characterize the energy performance of buildings. The base temperature used to calculate heating degree days is varied to match the reference or balance point temperature characteristic of the building being studied. This paper discusses (1) an iterative technique developed for estimating balance point temperatures; (2) concepts helpful in applying this and other techniques to utility billing data for single-family residences; (3) limitations of the iterative technique; and (4) a comparison between whole-house and submetered heating data results. This work shows that estimates of annual heating energy use are not affected greatly but that estimated savings for some retrofits can be significantly affected by finding the correct balance point. 2 refs., 5 figs., 1 tab.

44526 (CONF-850606—13) Predicted energy conservation in existing small commercial buildings. Mixon, W.R.; Kedl, R.J. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016419.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

Research has recently been completed to characterize typical small commercial buildings existing in the United States and to assess the potential of retrofit measures to reduce energy use and peak electric demand. The focus has been on commercial buildings that will be eligible under the Commercial and Apartment Conservation Service Program mandated by Congress; i.e., with annual energy consumption less than 48,000 kWh of electricity and 12,000 therms of any other fuel. Estimates of retrofit energy savings were based on representative physical and energy-use characteristics selected from information collected on 291 small commercial buildings in 9 cities. Energy-use profiles varied significantly with building type and location, but total annual energy savings of 26 to 49% were predicted from use of 5 common retrofit measures in modern strip-type and older two-story building models. Peak electric demand ranged from 15 to 50 kW for these models, with predicted retrofit savings of 4 to 29 kW. 2 refs., 1 tab.

44527 **(CONF-850606—14) Clathrates and conjugating binaries: new materials for thermal storage.** Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016408.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

Clathrates and liquid conjugating binary systems form the basis for new latent heat materials under investigation as storage media for offpeak building heating and cooling. Clathrate compounds formed with water as a constituent are particularly attractive for this application, because they freeze at temperatures higher than ice but still low enough for effective building cooling. Partially miscible binary systems that possess a usable heat of mixing in the building heating/cooling temperature range have also been identified. These offer an advantage as thermal storage media in that they remain in liquid form. This paper describes clathrate and conjugating binary storage concepts currently being explored and discusses the technical and practical issues involved with each other. 7 refs., 5 figs., 1 tab.

44528 **(CONF-8508111—3) Dynamics effects of utility energy conservation programs: a residential retrofit program example.** Hirst, E.; Keating, K. (Oak Ridge National Lab., TN (USA); USDOE Bonneville Power Administration, Portland, OR). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016296.

From National conference on energy program evaluation; Chicago, IL, USA (19 Aug 1985).

The Bonneville Power Administration (BPA) operated a Residential Weatherization Pilot Program from 1980 through 1982. The program provided free home energy audits to 7200 electrically heated homes in the Pacific Northwest and gave zero-interest loans to weatherize 4100 of these homes. The total cost of the program was almost $11 million. This paper estimates the energy-saving effects of the BPA program. The data used include one year of preprogram and three years of postprogram electricity consumption records. The total annual electricity saving experienced by the households that received both an energy audit and a weatherization loan averaged 5300 kWh/year one year after participation, increasing to 6000 kWh and 6500 kWh two and three years after participation. The net annual electricity saving that can be directly attributed to the BPA pilot program for these households averaged 4500 kWh (15% of preprogram use) one year after participation and declined to 4300 kWh two years and 4200 kWh three years after participation. 8 refs.

44529 **(CONF-8508111—4) Residential conservation incentives: a review of loan impacts.** Berry, L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016475.

From National conference on energy program evaluation; Chicago, IL, USA (19 Aug 1985).

Although incentive effects vary greatly from one program setting to another, it may be possible to set some rough boundaries on the magnitude of the effects, all else being equal, that they are likely to produce. The purpose of this paper is to review evidence on the magnitude of loan effects from a series of utility-sponsored home energy audit program impact evaluations. The studies reviewed in this paper produced estimates of loan impacts that vary from 20% to 300% more energy savings in loan programs than in audit only programs. Much of the difference in these estimates results from how well one controls for the effects of self selection, program setting, target population characteristics and levels of loan usage. It seems likely that at typical levels of response to loan programs (about 50% of audited customers using loans), with all else being equal, a loan program will produce about twice the energy savings of an audit only program. 10 refs.

44530 **(CONF-8509137—1) Thermal performance measurements of insulated roof systems.** Courville, G.E.; Childs, K.W.; Walukas, D.J.; Childs, P.W.; Griggs, E.I. (Oak Ridge National Lab., TN (USA); Tennessee Technological Univ., Cookeville (USA)). 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017097.

From 2. international symposium on roofing technology; Gaithersburg, MD, USA (18 Sep 1985).

Oak Ridge National Laboratory has established a Roof Thermal Researcch Apparatus for carrying out thermal and hygric experiments on sections of low-sloped roofs. Test panels are exposed to a controlled temperature interior space and to the prevailing East Tennessee exterior environment. They are well instrumented and all data are stored and aided in the analysis by computer systems. Current experiments include studies of the effect of wet insulation on membrane temperature, thermal storage phenomena in built-up roof insulation, and the effects of varying surface reflectance on roof thermal performance.

44531 **(DED-TR—84-01) Hangar heating and energy conservation manual. [Final report, October 1979-September 1983].** Ashley, J.L. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Sep 1984. 97p. Naval Civil Engineering Command Lab., Port Hueneme, CA 93043. File Number TI85901527.

Hangars and similar structures require large amounts of energy for space heating. Energy conservation survey techniques for hangars are defined and technical data sheets are included which provide (1) procedures to identify energy conservation deficiencies, (2) methods to calculate annual energy losses, (3) recommend solutions, and (4) methods to calculate annual energy savings.

44532 **(DGRST—80-7-0024) Absorption heat pump using the zeolite/water couple.** Ismail, I.; Meunier, F.; Paeye, G. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1983. 56p. (In French). (DGRST—80-7-0025). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751283.

The aim of the study is the numerical simulation and experimentation of the application of the zeolite-water couple, to a heat pump for industry or housing, using a high temperature heat source. The study includes modelling and description of the equipment; measurements and experimental results are presented.

44533 **(DGRST—81-D-0028) "SEVESEM" systems: heat pumps with incorporated energy storage systems.** Le Goff, P. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1982. 39p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751280.

The concept of an absorption heat pump is generalized by considering it as a thermal transformer with a primary circuit, a cascade of multiple Vaporizers-Condensers-Separators (abbreviated VACOSEP) and a second circuit, a cascade of multiple Vaporizers-Condensers-Mixers (abbreviated VACOMEL). A new type of VACOSEP and VACOMEL is patented. It is particularly simple, efficient and inexpensive to construct. Models of these devices have been tested on a test-bench specially constructed for this purpose. A pilot study of the complete system has been set up bringing together a boiler, a VACOMEL, a VACOSEP and energy storage reservoirs, for production of water at 75°C.

44534 (DOE/CE/24411—T1) Research support for the Residential Conservation Service (RCS) program and other DOE conservation programs. Final report. Hutton, R.B.; McNeill, D.L. (Denver Univ., CO (USA). Coll. of Business Administration). Nov 1984. Contract AC02-81CE24411. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016952.

This report summarizes the activities and products resulting directly and indirectly from the current contract. While the activities cover a wide range of efforts, two important themes should be recognized. Within the specific work for the contract, a logical stream of research activity was conducted. Each task provided new and useful information for developing marketing strategies for energy conservation programs. Each subsequent task was built around the results of previous tasks. This disciplined methodological approach provided both insightful and cost effective information for policymakers and practitioners involved in the design, implementation, and evaluation of energy conservation programs. The second theme inherent in each of the tasks described is the focus on the behavioral sciences and behavioral science research methodologies. It has been shown repeatedly that understanding the demand side of the marketplace produces effective programs that best meet the needs of the population. The use of behavioral science research methods allows not only for the assessment of program impacts, but also provides a better understanding of why program or program components may or may not be working. In summary, this contract has produced new and insightful information related to understanding the relationship between energy conservation and consumers. This information should prove valuable in the design, implementation, and evaluation strategies for future conservation efforts.

44535 (DOE/NBM—5015227) FEMP Update: Federal Energy Management activities, July 1984. (Federal Energy Management Program, Washington, DC (USA)). Jul 1984. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015227.

This newsletter highlights topics such as: shared savings contracts, energy conservation in buildings, retrofitting workshops, and other workshops.

44536 (DOE/R1/57125—T1) Procurement practices in state and local agencies within the Department of Energy low income weatherization assistance program. Final report. Task C. (Arawak Consulting Corp., New York (USA)). May 1983. Contract AC02-82R157125. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017173.

During the summer and fall of 1982, Arawak Consulting Corporation monitored a number of program management functions of the Low Income Weatherization Assistance Program in those states under the jurisdiction of the DOE Chicago Operations Office. Twenty grantees, plus 80 randomly selected subgrantees were monitored during the initial visit phase. An additional five subgrantees in three states were monitored as a part of the follow-up activities. While it appeared that almost all subgrantees and grantees were operating in accordance with DOE and other federal regulatory guidance, review of the monitoring instruments raised new concerns in several management areas. One of these areas is the procurement function of grantees and subgrantees. In response to questions raised by DOE concerning procurement, Arawak conducted a review of the information gathered during the initial monitoring effort, and recontacted by telephone 20 state weatherization directors. Arawak also requested that the grantees send copies of state-developed guidance pertaining to procurements. Objectives were to present a summary of the data analyzed and our findings regarding the procurement activities of grantees and subgrantees.

44537 (DOE/R1/57125—T2) Transferable methods identified during the monitoring of the DOE Chicago Operations Office Weatherization Assistance Program. Final report. Task F. (Arawak Consulting Corp., New York (USA)). May 1983. Contract AC02-82R157125. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017175.

This report provides the outcomes of the analyses performed under this task. The first of these is the presentation of a range of materials/approaches initially found by contract monitoring teams to be potentially unique/innovative/useful to Weatherization Program operators. The second is a summary of the general categories of information eventually selected as having good transfer potential. The third is a listing of areas of information currently needed by grantees. The final step is a matching of useful information to needs cited by grantees.

44538 (DOE/R1/57125—T3) Analytic methodologies for program evaluation for the Department of Energy Low Income Weatherization Assistance Program, task B. Final report. (Arawak Consulting Corp., New York (USA)). May 1983. Contract AC02-82R157125. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017172.

This report presents three diagnostic tools intended as management aids in DOE's oversite of the Low Income Weatherization Assistance Program (WAP). A need for such tools was demonstrated during the course of a 20 state monitoring effort conducted for WAP in 1982 by the Arawak Consulting Corporation. At the conclusion of the project, the monitors proposed that some methodologies for comparing the performance of local agencies should be developed. All three of these tools which were developed utilize the same data elements for the basis for analysis: Number of units weatherized; amount of funds expended on installed weatherization materials; and subgrantee labor costs. These three data elements can be aggregated and analyzed from several different viewpoints and levels of complexity; the diagnostic tools themselves are presented in an ascending order of complexity. For the purpose of explication, the assumption is made that a weatherization program evaluation is being performed. This implies that all data collected and analyzed is based upon a subgrantees' total weatherization effort, whatever the funding source. The discussion of each tool includes a presentation of its explanatory scope, its data requirements, the tool's predictive limitations, and the probable management uses for each.

44539 (DOE/R1/57125—T4) 1982 HHS/LIHEAP funds used for weatherization. An analysis of data from twenty states: Task A. Final report. (Arawak Consulting Corp., New York (USA)). May 1983. Contract AC02-82R157125. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017171.

During the Summer and Fall of 1982, Arawak Consulting Corporation monitored a number of program management functions of the Low Income Weatherization Assistance Program (WAP) in the 20 states under the jurisdiction of the DOE Chicago Operations Office. The monitoring included on-site visits to all 20 state grantees and 85 randomly selected local subgrantees. Although the monitoring was designed to focus only on the DOE funded program, it soon became apparent that funds from the Department of Health and Human Services' Low Income Home Energy Assistance Program (LIHEAP) often had a significant effect on the scope and mode of operation of the weatherization program. As a result of these and other outcomes, DOE asked Arawak to further study the impact of HHS funds on the Weatherization Assistance Program in the same 20 states. This report is the result of that request. It draws on information collected during the monitoring visits which were conducted from mid-July to mid-October 1982, and on additional information obtained in telephone interviews during the last two weeks of February 1983.

44540 (DOE/R1/57125—T15) Revised grantee and subgrantee weatherization monitoring instruments and pre-tests. Final report. Tasks D and E. (Arawak Consulting Corp., New York (USA)). May 1983. Contract AC02-82R157125. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85017174.

During the summer and fall of 1982, Arawak Consulting Corporation monitored a number of program management functions of the Low Income Weatherization Assistance Program in those states covered by the four support offices (Boston, New York, Philadelphia and Chicago) under the jurisdiction of the DOE Chicago Operations Office. Nineteen states and the District of Columbia, plus 80 randomly selected local subgrantees within the 19 states were monitored during the initial visit phase. An additional 5 subgrantees in three states were monitored as well. Upon completion of these monitoring tasks, Arawak's contract was extended and

modified by DOE to include seven additional tasks. Tasks D and E, which are the subject of this report, involved revision to, and pretesting of, the monitoring instruments. This report summarizes the activities undertaken by Arawak in the process of revising the monitoring instruments and conducting field tests of the revised instruments at two grantee and three subgrantee sites.

44541 **(DOE/R4/10252—T1) Partitioning of gas or oil furnaces and water heaters to reduce drafts. Final report.** Goerz, J.W. (Goerz (Jerry W.), Lexington, KY (USA)). 30 Sep 1983. Contract FG44-80R410252. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016809.

The goal of this experiment was to determine if energy could be saved by providing furnaces and water-heaters with "make-up air" (air for combustion) from outdoors, instead of drawing this air from inside the house. By not drawing air which has already been heated and humidified from the house, cold air infiltration through cracks in windows, doors and walls should be reduced, and the furnace should not need to run as much. To conduct this experiment, six residences were modified, in addition to the previous modification of the grantee's residence. These modifications all involved natural gas heating systems, some mounted in closets in the living space, other mounted in basements and crawlspaces. In the case of furnaces located in crawlspaces, the crawlspaces were sealed from the outdoors and make-up air was ducted into the furnaces from outdoors, in an effort to reduce heat loss across uninsulated floors. To summarize briefly the project results: at the Payne, Durham, and Eizenstat residences, modification apparently improved efficiency by 7.4%, 19.5%, and 3.9% respectively. At the Scheer, Mercer, and Smith residences, modification apparently degraded efficiency by 1.2%, 10.7%, and 12.3% respectively. At the grantee's residence, the effects of heating-system modifications was obscured by other efficiency-altering activity.

44542 **(DTH-LV—144) Insulated shutters.** Byberg, M.R.; Engelund Poulsen, K.; Rasmussen, N.H.; Solfeldt, H.S. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Dec 1983. 69p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752490.

In a single family house in Denmark about 35-50% of the total heat loss occurs through the windows. The main problem is the heat loss at night, because during the winter the nights are longer and colder than the days. This can be remedied by applying movable insulation in front of the windows. In this way the heat loss will be reduced and furthermore, also the cold draughts near the window. As external shutters have earlier been investigated, the project "Insulated Shutters" deals with internal insulated shutters for existing building and with shutters between two layers of glass for new building. Both types of shutters have been tested in a climate chamber and show considerable reduction of the transmission coefficient even for the double pane window when used at night. Thus the annual energy saving will be 900-1400 kWh for a typical Danish single family house with a window area of 20 m^2. No figures of actual investments have been available as the prototypes are handmade. The present day value method has been used for finding the maximum cost-effective investments. The analysis indicates that the internal shutter will have to have a lifetime of about 10 years to make the investment cost-effective and the shutter between the panes will have to have a lifetime of about 20 years. Furthermore, humidity tests have shown that under normal winter conditions there are no condensation problems. Under severe winter conditions the cold panes will steam up for a short time when the shutters are removed. The airtightness of the window element for new building is acceptable and that of the double glazed sealed unit is excellent independent of the shutters.

44543 **(EUR—8953-DE-EN) Temporary thermal insulation in the passive solar utilisation. June 24, 1983.** Fuhse, W.; Fuhse, A.; Fuhse, F.J.; Frank, I.; Hazebroucq, B. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 131p. (In German). Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A super inulating rolladen is developed, which gives an effective temporary thermal insulation (night insulation) for the passive solar utilisation. The k-value of the thermal insulation device - in connection with a double glazing - is about 0.5 W/m^2K, which is the insulation of a very well insulated wall. In order to present a most cost effective design, our research has focused on a concept, using standard rolladen components to a large extent. The work programme covered conceptual work, set up of a testing- and proving stand, performance of heat transfer measurements and initiation of life tests and proving programme. The design work took account of the structure to withstand influences like storm, hale, dust, rain, solar radiation, and mechanical strains. Other design criteria were low maintenance costs, long lifet time, good architectural integration of the rolled up device and easiness of operation. A prototype series of rolladen elements have been produced for the thermal and mechanical tests. The thermal effectiveness of the rolladen and the mechanical stability have reached the design goal. The work has shown, that the boundary effects are of great importance on the overall performance. Several guidance and sealing techniques have been tested, which keep the losses by air infiltration and thermal conductivity low. Future work has to cover the large scale production aspects, the broadening of the range of technical adaptability, improved thermal testing and architectural integration.

44544 **(FRNC-TH—1931) Contribution to the study of chemical heat pumps: the $CaCl_2$-NH_3-heptanol system.** Mayorga Vera, J.L. (Institut National Polytechnique, 31 - Toulouse (France)). 1982. 173p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752374.

Thermodynamic and kinetic study of the $CaCl_2$-NH_3-Heptanol system used in chemical heat pump cycles with the aim of beneficiating low-level thermal energy and/or cold producing. By implementing reversible chemical reactions the theoretical yield is close to that of Carnot. The reaction steps take place in the presence of an inert solvent, and the simultaneous heat and mass exchanges observed are very clearly improved with respect to the gas-solid reaction. The kinetic study of the steps of synthesis and of decomposition of the compounds formed has permitted the dimensioning of a 10 kW CHP applicable to the heating of buildings and to low-temperature refrigeration (-40°C).

44545 **(LBL—17444-Rev.) CONTROLITE 1.0 Lighting Control Systems and Daylighting Analysis Program: user's manual. Revision.** (Lighting Technologies, Boulder, CO (USA)). Jan 1985. Contract AC03-76SF00098. 138p. (EEB-L—84-02). NTIS, PC A07/MF A01; GPO Dep. File Number DE85016483.

In theory, a lighting control system which continuously monitors the available artificial and natural light within a space and supplies only the power required to provide light to meet some specified criteria illuminance level, and no more, should be able to optimize the energy savings capabilities of that lighting control system. Because of the potential for constantly varying power consumption due to this Equi-Illumination Dimming (EID) system, the computer is employed to help in modeling their performance. This computer program, CONTROLITE, provides an unbiased mathematical model from which comparisons can be made, on an economic basis only, of how different systems perform. The program has the option of calculating daylighting values, or allowing the user to specify the daylighting values as input. Calculations can also be done on simple control systems which do not respond to daylighting. For purposes of allowing for the calculating of daylighting values, program CONTROLITE is augmented with an accurate yet quick subprogram QUICKLITE. QUICKLITE employs what is known as the daylight factor method for calculation of daylighting values. In addition to invoking QUICKLITE to provide data to CONTROLITE, QUICKLITE may be executed by itself to allow the user to perform interior daylighting calculations. The CONTROLITE program analyses control schemes exclusively on an economic basis, considering only the energy consumed directly by the lighting system. No attempt has been made to account for any additional savings realized in HVAC systems when lighting systems are controlled. The program makes no statement about the user acceptance of lighting control systems or about the aesthetic qualities of the use of daylighting within interior spaces.

44546 (LBL—18755) Energy Analysis Program. Annual report, FY 1984. Cairns, E.J.; Rothkopf, M. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016495.

The Energy Analysis Program is engaged in interdisciplinary activities in which analysts from different fields work together on issues of national significance. The program's emphases on economics, public policy, and behavioral science distinguish it from other LBL activities. At the same time, however, engineering and technical analyses underlie its economic and policy studies, a foundation that distinguishes its work from that of most other analysis groups working on public policy issues. Virtually all of the program's research and analysis is quantitative, and much of the research staff is engaged in developing and applying mathematical models. At present, the work of the Energy Analysis Program emphasizes the study of energy use in buildings. This subject has been stressed for a number of reasons; one of the most important is the strong research effort within the Applied Science Division on energy conservation in buildings (especially the Energy Efficient Buildings and Solar Energy Programs). The Energy Analysis Program provides a rigorous and extensive capability in energy economics and analysis that complements the more technical pursuits of other groups in the Division studying energy in buildings. Some of the projects described have already provided a solid start to a systematic analysis of the issues studied.

44547 (NBS/TN—1201) Weatherization of residences: criteria for retrofit materials and products. Rossiter, W.J. Jr.; Mathey, R.G. (eds.). (National Engineering Lab. (NBS), Washington, DC (USA)). Aug 1984. 71p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016791.

Supersedes NBS Technical Note 982.

The Department of Energy (DOE) requested the National Bureau of Standards to review and update criteria for materials and products to be included in the DOE Weatherization Assistance Program. This Program was established by Congressional legislation in 1976 and was directed toward providing financial assistance to low-income individuals for retrofitting residences to conserve energy. In most cases, only energy-saving materials and products for which standards and specifications are available are to be included in the Program. In late 1983 DOE proposed rule changes to the Program which made it necessary to update existing criteria and establish, as appropriate, new criteria. Criteria are given for retrofit materials and products included in the DOE Weatherization Assistance Program. These materials and products are thermal insulation, storm windows and doors, replacement windows and doors, caulks and sealants, weatherstripping, vapor retarders, clock thermostats, and replacement glazing. The criteria are based on a consideration of factors such as thermal performance, fire safety, durability, quality, conformance to building codes, use, and ease of installation. The retrofit materials and products are listed by generic type along with pertinent standards and specifications. Precautions to be followed during their installation are also given for each of the items. Fire safety requirements for thermal insulations are recommended with regard to the use and locations where they are installed. 53 refs., 1 fig., 15 tabs.

44548 (PB—85-206282/XAB) Thermal and environmental performance of the Aylmer Senior Citizens Residence. Final report. (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Sep 1984. 105p. NTIS, PC E06/MF E01.

Prepared in cooperation with Enermodal Engineering Ltd., Toronto (Ontario). Sponsored by Ontario Ministry of Energy, Toronto.

The purpose of this study is to evaluate the thermal and system performance of the Aylmer Senior Citizens Residence. The study uses four years of detailed monitored data to determine the performance of six building systems: building shell, solar collection system, solar storage tank, heating system, domestic hot water system, and ventilation system. System effectiveness is determined through a comparison of system performance as predicted during design, and system performance as measured by the monitored system.

44549 (PB—85-209187/XAB) Energy 85: energy use in the built environment. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 339p. (D—1:1985). NTIS, PC E13/MF E01.

Color illustrations reproduced in black and white.

This work presents the part of the national energy research program concerned with energy use in the built environment, i.e. research, development, and experimental building and demonstration activities concerned with solar energy, heat pumps, heat storage and heat distribution, as well as with system and implementation aspects. It is also concerned with support for research, development, experimental building and demonstration activities relating to energy conservation and energy-management measures in new and existing buildings and built environments. The review is intended to illustrate and quantify the potential for energy savings and the actual savings achieved in the existing built environment and, if possible, also to determine how great a proportion of the potential for energy saving can be related to buildings in areas that may be supplied with district heating.

44550 (PB—85-220663/XAB) Integrated gas-fired space-heating/water-heating system with electric air conditioning. Annual report, January 1984-December 1984. Celorier, G.M.; Demetri, E.P.; Gerstmann, J. (Advanced Mechanical Technology, Inc., Newton, MA (USA)). Jan 1985. 54p. NTIS, PC A04/MF A01.

The performance of the engineering model of a gas-fired space- and water-heating system with electric air-conditioning has been improved. Modifications to the Phase I engineering model yielded a measured space-heating stack efficiency of over 90% and water-heating recovery efficiency of 85% with standby losses of 1.1% per hour. A Phase II prototype TIA has been designed that incorporates the modifications and improvements made on the Phase I engineering model. Forty-eight Phase II prototypes will be built and field tested. The redesigned package has been reduced to 66 inches, and component placement has been revised to improve accessibility and serviceability. A field-test method has been devised, and work has started on the selection of test sites for the field test.

44551 (CE-Trans—2735) Energy saving heating systems in Danish homes. Zimmermann, H. Translated from *Elektrowaerme International, Edition A: Elektrowaerme im Technischen Ausbau ;* **43**: No. A1, 21-24(Jan 1985). 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902070.

The costs of the main energy forms for heating homes in Denmark are very high. Therefore greater efforts have been made to build houses with especially low heat requirements. The paper describes six model houses with various heat generators and different heat insulation measures. All the houses needed to have a ventilation system with heat recovery, which is also described.

44552 A new bioclimatic chart for environmental design. Arens, E.; Zeren, L. (University of California). pp 645-653 of Building energy management-conventional and solar approaches. De Oliveira, F.E. Oxford, GB; Pergamon Press (1981). (CONF-800524—).

From International congress on building energy management; Povoa de Varzim, Portugal (12 May 1980).

The purpose of this study was to update the bioclimatic chart of Olgyay using the best currently available research on human response to the thermal environment. Much work has been done on human response in the 27 years since the chart's first publication. The chart shows a wide range of the four thermal variables (air temperature, humidity, air motion and radiation) which will be judged thermally acceptable by persons wearing usual indoor clothing and slightly active (as in office work). The chart is designed to be used with local climate data in the conceptual design process of a building. Olgyay also provided a book detailing many design strategies and components to aid the designer to take maximum advantage of the climate, and therefore provide acceptable comfort conditions with low energy use. The energy problem will increase the use of procedures like this in the future. Since engineers are more used to using psychrometric charts than the temperaturerela-

tive humidity cartesian format of the original Olgyay chart, a psychrometric representation has also been presented.

44553 **The annual cycle energy system, characteristics and performance.** Abbatiello, L.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). pp 565-575 of Building energy management-conventional and solar approaches. De Oliveira, F.E. Oxford, GB; Pergamon Press (1981). (CONF-800524—).

From International congress on building energy management; Povoa de Varzim, Portugal (12 May 1980).

The Annual Cycle Energy System (ACES) provides space heating, air conditioning, and domestic water heating while using substantially less energy than competing systems providing the same services. The ACES is based on an electrically driven, unidirectional heat pump that extracts heat from an insulated tank of water during the heating season. As the heat is extracted, most of the water freezes, and the stored ice provides air conditioning in the summer. A single-family residence near Knoxville, Tennessee is being used to demonstrate the energy conserving features of the ACES. A second similar house, the control house, has been used to compare the performance of the ACES to both an electric resistance heating and hot water with central air conditioning system and an air-to-air heat pump system. The results of the first year's operation from November 1977 through mid-September 1978 showed that the ACES consumed 9012 kWh of electricity while delivering an annual coefficient of performance (COP) of 2.78. The control house consumed 20,523 kWh of electricity while delivering an annual COP of 1.13. The second annual cycle was started on December 1978. The ACES was compared with an air-to-air heat pump during this period. During the ice storage portion of this test year, December 1, 1978 to September 1, 1979, 5705 kWh of electricity was used by the ACES, compared to 12,014 kWh for the control house. The respective COPs are 1.40 for the control house with the heat pump and 2.99 for the ACES house during this period. Annual energy consumption for the test year was 6597 kWh and the annual COPs were 1.41 for the control house and 2.81 for ACES. ACES is achieving its anticipated performance. This paper describes and defines the ACES concept and its general engineering performance as compared to conventional HVAC systems.

3202 Transportation

44554 **(AD-A—154137/4/XAB) Radiative-augmented combustion. Annual report No. 1, 15 July 1983-14 July 1984.** Lavid, M. (M.L. Energia, Inc., Princeton, NJ (USA)). 10 Aug 1984. 55p. NTIS, PC A04/MF A01.

Continuation of work performed under Contract F49620-81-C-0028, Exxon Research and Engineering Co., Linden, NJ.

Radiative-augmented combustion has been identified as a potential technique for extending aircraft operating limits associated with combustion processes. This technique is based on the fact that radiation of selected wavelengths is capable of photodissociating stable molecules, combustion intermediates, and other inhibiting species in the flame zone into reactive radicals. Subsequent reactions involving these reactive radicals lead to radiative ignition and combustion enhancement. This program emphasizes research on the interaction between radiation and combustion under flow conditions. Research is divided into two main subjects; ignition and enhancement. The objective of the experimental work is to demonstrate both ignition and enhancement in flow systems. For this purpose, two specially tailored pieces of equipment were designed and fabricated; a plug-flow combustor to conduct radiative ignition tests, and a pancake burner to measure combustion enhancement in terms of increase in burning velocity. It is expected that experiments will demonstrate proof of concept by igniting combustible mixtures at conditions where thermal ignition is unreliable, and by increasing the flame speed. Since the role of photochemical reactions within the whole kinetic scheme is currently not completely understood, it is further expected that this research will identify the most effective photodissociative paths. This, in turn, will assist in determining the feasibility of the concept based on the availability of newly developed light sources and their compatibility with the harsh combustion environment.

44555 **(BMFT-FB-W—85-004) Development of new combustor technologies for future alternative aero-engine fuels - phase 1.** Simon, B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Motoren- und Turbinen-Union G.m.b.H., Muenchen (Germany, F.R.)). Jun 1985. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752668.

The report gives an overview of the present situation concerning the aircraft fuel supply and the resulting consequences for the specification of future aircraft fuels. This leads to increasing smoke emissions and combustor wall temperatures. Main task of the project was the development of an air blast type fuel injector system which gives very low smoke emissions and therefore decreases the thermal strain of the flame tube walls. This system was tested in a reverse flow annular combustor. The present report summarizes the results of the phase I (1982-83) of the project.

44556 **Erosion rate of reaction-bonded SiC containing various amounts of free silicon.** Routbort, J.L.; Turner, A.P.L. (Argonne National Lab., IL). *Wear;* **84**: 381-385(1983). Contract W-31-109-ENG-38.

While there have been indications that microstructure may play a significant role in the determination of the solid particle steady state erosion rate of brittle materials, the effect has never been systematically investigated. The results of erosion studies obtained on two types of reaction-bonded (RB) SiC having different amounts of free silicon are reported. These results are compared with those obtained previously using an RB SiC having approximately the same percentage of free silicon but having a different morphology. The results allows an assessment of the effects of both free silicon and microstructure on the solid particle erosion rate.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 43661, 43736, 43736, 43922, 43949, 44016, 44017, 44920, 45209, 45210, 45211

44557 (CONF-801197—, pp 45-49) **Heat reovery for high-temperature corn dryers.** Warren, T. (DeKalb County Farm Bureau, Somonquk, IL). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Described is process to recover 60% of the warm air usually lost from an on-farm crop dryer. The dryer was operated in 1976-1977 without the heat recovery system and in 1978-1979 with it. There was a 17% reduction in power used and a 33% reduction in propane used with the heat recovery system. In 1980, the converted dryer will save $200.00 in electric power charges and $3500.00 in propane. The cost of the improvement is approximately $1075.78 plus 183 hrs of labor. (DMC)

44558 (CONF-801197—, pp 58-64) **No-till, fuel soil and time saver.** Frederick, W. (Cedar County Farm Bureau, West Branch, IA). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The author uses no-till on about half his row crop acres and is continuing to expand its use. He estimates no-till saves about 10 to 20% of his total farm energy budget. He estimates a young farmer could buy all brand new machinery to raise 500 acres of corn and soybeans NO-TILL for $50,000 to $60,000; (no combine, wagons, or harvesting - just raising). He states, "I have no need for more than a 100 to 125 horse tractor with NO-TILL."

44559 (CONF-801197—, pp 78-85) **Till plant system.** Davis, V. (Jefferson County Farm Bureau, Ft. Atkinson, WI). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The author has moved from conventional tillage to a till-plant system. That move has saved him about 2000 gallons of diesel fuel per year on his 750 acres. Two keys to the till-plant system are: (1) proper seedbed preparation during the preceding crop year; and (2) adjustment of combine and tractor wheels do not damage ridges once they are established.

44560 **(DOE/CE/40699—T2) Case studies of industrial energy conservation among small and medium-size manufacturers. Volume II.** Deevy, L.M.; Perrotti, G.M. (University City Science Center, Philadelphia, PA (USA). Center for Energy Management and Industrial Technology). Jul 1985. Contract FC01-84CE40699;FC01-83CE40654. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016932.

The Energy Analysis and Diagnostic Center (EADC) program has been providing direct assistance in energy conservation to small and medium-size manufacturers since 1976, under the management of University City Science Center (UCSC). At the conclusion of the 1983-1984 period of the EADC program it had served a total of 1139 manufacturing plants. Energy audit teams, composed of university engineering faculty and students, visit the plant of each manufacturer served, review the manufacturing operations and other categories of energy use, measure the efficiency of energy usage, and recommend opportunities to lower energy consumption and reduce the associated costs. These recommendations are then analyzed for their feasibility and cost-effectiveness and presented in a report to the manufacturer. Every report includes at least three energy conservation opportunities or ECOs, together with calculations and engineering estimates of the savings that would result and the expected cost to implement them.

44561 **(DOE/CS/24428—T1) [Cogeneration feasibility studies for Massachusetts]. Final technical report.** (Massachusetts Executive Office of Energy Resources, Boston (USA)). 1983. Contract FG01-80CS24428. 825p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85012621.

This analysis of energy resource management in Massachusetts emphasizes all aspects of electric power cogeneration: environmental, economic, regulatory engineering feasibility, and financing. Exhaustive documentation is presented for each of the above topics.

44562 **(DOE/CS/40211—T1) Development of a cold corrugating process. Final report.** Sprague, C.H. (Institute of Paper Chemistry, Appleton, WI (USA)). May 1985. Contract AC02-79CS40211. 638p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85017238.

This report covers four project phases. An executive summary is included. In the second section, the basic process elements of forming and bonding are covered separately. The pilot trials work is covered in Section III, while Section IV is devoted to commercial prototype system development and evaluation: specification and acqusition of the system components; checkout tests and the system modifications; and results obtained from the system.

44563 **(EUR—9117) Heating of a laboratory hall by means of a soil heat pump combined with unshielded solar absorbers.** De Hoe, J.M. (Commission of the European Communities, Luxembourg). 1984. 29p. Commission of the European Communities, Luxembourg.

A laboratory hall was heated by three heat pumps each of them using a horizontal ground heat exchanger as the only heat source during a first heating season. The installation performances were in good accordance with the results predicted by a simulation programme. Two of the existing soil heat exchangers were combined with energy absorbers during the two next heating seasons. No clear improvement of the yearly global COP followed from such a combination. A short start-stop cycle time reduces the H.P. COP, the insertion of buffer tanks did not improve the yearly global COP. The stand-by consumption of the H.P. when the compressor is turned off is not negligible when the H.P. is running only a few hours a week. The matching between H.P. without power control and energy absorbers is unfavourable because the H.P. are dimensioned for covering the nominal heat losses. Assistance of the soil heat exchanger by energy absorbers does not seem to be attractive but can bring a solution when the available soil surface is too small. A promising alternative for energy absorbers is their use as the only heat source of a bivalent H.P. system but cost reduction is a must.

44564 **(FRCEA-R—11) Reduction of energy consumption in horticulture: solar greenhouse and utilization of tepid waters.** Balligand, P.; Fourcy, A.; Dumont, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Sep 1984. 9p. (In French). NTIS (US Sales Only), PC A02. File Number DE85751285.

First, the main principles of a double filtering shell greenhouse with a water circulation to recover heat from solar energy are presented. Plastic tubes are used as heat exchangers to heat the plants and the ground. The combination of plastic sleeves, thermal effluents and solar energy allow energy conservation.

44565 **(LITH-IKP-R—334) Use of energy at heat treatment - Possibilites of improvement.** Soederstroem, M. (Linkoeping Inst. of Tech. (Sweden). Dept. of Mechanical Engineering). 1984. 59p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752504.

Heat treatment is very energy intense. A number of ideas concerning energy conservation are presented. Real problems have been studied by measuring various processes. The results are discussed and proper energy conservation is suggested. The application of surplus energy, energy storage and load control is described. Concentration on a single energy species such as electric power is not considered risky for this branch.

44566 **(PB—85-189066/XAB) Evaluation of hazardous-waste incineration in an aggregate kiln: Florida Solite Corporation. Summary report.** Day, D.R.; Cox, L.A.; Peters, J.A. (Monsanto Research Corp., Dayton, OH (USA). Dayton Lab.). Apr 1985. 112p. NTIS, PC A06/MF A01.

Aggregate kiln incineration of chlorinated liquid organic waste was investigated in a one-week program at Florida Solite Company. POHCs (toluene, tetrachloroethylene, methyl ethyl ketone, and methyl isobutyl ketone) were monitored in waste and stack emissions. In addition, stack emissions were monitored for particulate matter, particulate trace metals, HCl, SO_2, and NOx. Process samples were collected and analyzed for trace metals and chloride. The destruction and removal efficiency of POHCs and the fate of trace metals and chloride ion in the kiln process were determined.

44567 **(PB—85-192896/XAB) Improved boiler control in food factories. Final report.** Withman, W.E. (Commission of the European Communities, Luxembourg). 1984. 87p. (EUR—8924-EN). NTIS, PC E05/MF E05.

This project was undertaken to explore the possibilities of making useful energy savings in an actual factory by making a continually updated forward forecast of steam demand, which would be used to manage the steam generation and distribution system in the most cost-effective manner.

44568 **(PB—85-199602/XAB) Advanced regenerative heat-recovery system. Final report, September 1982-April 1984.** Whitbeck, R.G. (Midland-Ross Corp., Toledo, OH (USA). Energy Technology Div.). Aug 1984. 106p. NTIS, PC A06/MF A01.

A new concept heat-wheel regenerator has been developed to recover heat from a wide range of industrial heating processes. The heat-wheel design separates the heat-transfer matrix from the areas to be sealed so that better sealing performance can be expected and ceramic heat-transfer matrix materials can be used. The design is expected to make it possible to expand the usage of heat-wheel regenerators to high-temperature (2000F and higher), high-flow industrial processes. Two proof-of-concept heat wheels were installed and laboratory tested.

44569 **(OA-tr—2724) High-performance heat recovery system for ventilation plants.** Richarts, F.; Halupczok, J.; Hendrokusumo, G. Translated from *Heizung-Lueftung-Haustechnik ;* **35**: No. 11, 537-542(Nov 1984). 21p. NTIS, PC A02/MF A01. File Number DE85901479.

The heat recuperator combines the advantages of different methods of heat recovery, namely circulation systems and heat pumps. The working principle is explained, and the operating behavior and characteristic diagram are drawn up on the basis of the operating properties of the components. The overall evaluation of the system in terms of energy saving is based on an annual energy balance which because of the distinctly non-linear behaviour of Krantz is much more complicated to prepare than with other heat recuperators.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 43657, 43925, 43948, 43950, 43951, 43954, 44077, 44166, 45168

44570 **(PB—85-198075/XAB) Fuel-efficient incineration for disposal of sewage sludge.** Wall, H. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). 1985. 8p. (EPA—600/D-85/099). NTIS, PC A02/MF A01.

The City of Indianapolis, Indiana, demonstrated that 34 to 70% of the fuel used for sewage-sludge incineration could be saved. These savings were the result of study of how sewage sludge incineration in a multiple hearth incinerator works, adding instrumentation and controls to the furnace system and training the operators in the technical aspects of sludge incineration. This program saved Indianapolis about $1,000,000 in fuel and maintenance repairs. This fuel-efficient mode of operation also reduced the air pollution from sewage sludge incineration and allowed the city to cancel a $3,000,000 construction program for air-pollution-abatement equipment for sewage-sludge incinerators. Other cities - Nashville, TN; Hartford, CT; and Buffalo, NY - have also adopted the fuel-efficient mode of operation and realize a savings from 40 to 50% less fuel usage for sewage-sludge incineration.

3209 Education And Public Relations

44571 **(DOE/IR/10295—T6) Energy education programs: perspectives for Community, Junior, and Technical colleges.** Settlemire, M.A. (American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center). 1981. Contract FG05-79IR10295. 42p. American Association of Community Junior Colleges, One Dupont Circle, NW, Washington, DC 20036. File Number TI85017404.

Sections 1 to 4 offer perspectives on US energy use, legislation, manpower projections, and the roles of two-year colleges. Section 5 presents some major program concerns and problems. Section 6 identifies some important information resources for program funding. A bibliography appears in the Appendix.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 45766

44572 **(DOE/IR/10022—T1) Ionic fuel control system conversion to operational configuration. Final report.** Durbin, E.J. (Durbin Associates, Princeton, NJ (USA)). [1985]. Contract FG01-79IR10022. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015219.

The flow sensor described in a previous report has been adapted to the Ionic Fuel Control System to provide a constant cylinder to cylinder air fuel ratio, manifold lag compensation, and a provision for change during idling and maximum torque periods, as was specified in task 6.

44573 **(PB—85-204741/XAB) Cost of selected trap-oxidizer system components for heavy-duty vehicles. Final report.** (Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA); Mueller Associates, Inc., Baltimore, MD (USA)). 28 Sep 1984. 32p. NTIS, PC A03/MF A01.

Prepared in cooperation with Mueller Associates, Inc., Baltimore, MD.

This report describes the estimated costs of selected trap-oxidizer system components for heavy-duty vehicles. This report also provides the rationale used for selecting the cost-estimation approach and the actual-cost-estimation methodology used. Also included is the description of the trap-oxidizer systems considered and the cost of the components.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 44447

44574 **(TVA/PE/EDT—85/10) Electric vehicle charger test plan. Revision 1.** Driggans, R.L.; Reese, R.W.; Keller, A.S. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). May 1985. 35p. NTIS, PC A03/MF A01. File Number DE85901749.

This report describes the revised test plan developed under the battery charger testing work task of the Electric Power Research Institute (EPRI)/Tennessee Valley Authority (TVA) electric vehicle project. This test plan covers the tests performed and the procedures used to evaluate chargers. Measurements made during testing include (1) charger-induced distortion of input signals, (2) charger output characteristics, and (3) charger-induced radio frequency interference to communication equipment. Additionally, operating efficiencies are calculated and physical characteristics are noted. The testing is performed using precision volt-amp-watt meters, frequency counters, a digital storage oscilloscope, and a spectrum analyzer.

3307 Emission Control

REFER ALSO TO CITATION(S) 44573

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 43921, 43923, 44157, 44555

36 MATERIALS

REFER ALSO TO CITATION(S) 43618

44575 **(CONF-850840—13) Nickel oxide morphology in nickel-silica catalysts.** Dhere, A.G.; Reucroft, P.J.; De Angelis, R.J.; Bentley, J. (Kentucky Univ., Lexington (USA). Dept. of Metallurgical Engineering and Materials Science; Oak Ridge National Lab., TN (USA)). 1985. Contract AS05-82ER12098;AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016963.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

An 11.9% Ni/SiO_2 catalyst was prepared by nitrate impregnation. TEM showed a facetted void structure, and bunched Ni particles and larger rafts. (DLC)

44576 **(CONF-850877—1) Optimizing estimates of long-range order parameters with Bragg x-ray scattering data.** Yakel, H.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016589.

From American Crystallographic Association meeting; Stanford, CA, USA (18 Aug 1985).

This document comprises oversize graphs divided into: assumptions, analysis, and conclusions. The conclusions were experimentally tested on spinels MM_2O_4, sigma phases, and tau carbides $M_{23}C_6$. (DLC)

44577 (CONF-8111229—) Proceedings of the symposium on surface science and its industrial implications, incorporating colloquim on Auger electron spectroscopy in South Africa. Gries, W.H.; Crooke, M. (eds.). (Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.). 1981. 223p. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

Separate abstracts were prepared for papers given at the symposium on surface science and its industrial implications. The symposium was held in Pretoria, South Africa, November, 1981.

44578 (SAND—85-0853) Ultrasonic longitudinal wave velocity in carbon-carbon Pitch and Pitch/M2 shape stable nosetip material from 70°F to 5400°F. Gieske, J.H. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017330.

A pulse echo method was used in two notched rods of carbon-carbon Pitch material and one rod of Pitch/M2 shape stable nosetip material to measure the temperature dependence of the longitudinal wave velocity from room temperature to 5400°F. The velocity was constant to within 2% of the room temperature value for the Pitch parent material throughout the temperature range. For the Pitch/M2 material, the velocity increased to a maximum of 10% at 4000°F and then decreased rapidly. Room temperature velocities in the principal directions of the composite are also given for the two Pitch rods, which showed a 15% decrease in velocity near the ends of both rods and near the side of one rod.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 43629, 44023, 44161, 44183, 44184, 44186, 44186, 44186, 44189, 44190, 44192, 44212, 44212, 44215, 44230, 44251, 44253, 44253, 44260, 44261, 44262, 44263, 44264, 44265, 44266, 44267, 44268, 44269, 44288, 44290, 44335, 44339, 44375, 44414, 44417, 44417, 44418, 44440, 44441, 44510, 44736, 44774, 44787, 44875, 44992, 45389, 45726, 45731

44579 (AD-A—954473/5/XAB) Armor - preliminary study of the effect of several alloying elements and addition agents upon the metallurgical properties of manganese-molybdenum steel used in armor. Riffin, P.V. (Watertown Arsenal, MA (USA)). 3 Sep 1943. 26p. NTIS, PC A03/MF A01.

The purpose of this study is to determine the effect of small amounts of tin, titanium, tellurium, selenium, zirconium, niobium, boron, and four commercial types of addition agents on the hardenability, V-notched Charpy impact properties, physical properties, and microstructure of a 0.30% carbon manganese-molybdenum type of steel.

44580 (AECL—8051) Purification of zirconium by electrotransport. Zee, R.H.; Watters, J.F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701942.

An electrotransport apparatus for purifying reactive metals is described. A large d.c. current (approximately 10 A/mm^2) is applied to the specimen inside an ultra high vacuum chamber. This chamber is evacuated using an ion pump and a titanium sublimation pump. It is bakeable to 650K and is capable of maintaining a vacuum of 7 x 10^{-8} Pa. Resistivity ratio results from several preliminary runs in zirconium indicate a reduction in overall impurity level by 60 percent after a typical run at 1750K for approximately 120h.

44581 (CEA-CONF—7358) Ion mixing and radiation induced segregation in the Fe, Ni, Si system. Gerard, P.; Fromont, E.; Suran, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jun 1984. 1p. (CONF-8406129—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751170.

From MRS European meeting; Strasbourg, France (5 Jun 1984).

Published in summary form only.

44582 (CEA-CONF—7450) Study of crystalline and amorphous DyAg by muon spin relaxation. Asch, L.; Boucher, B.; Chapper, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1984. 13p. (CONF-8409102—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752068.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

Longitudinal zero field μSR experiments in crystalline and amorphous DyAg have been carried out. In crystalline DyAg we find a rather slow temperature variation of rare earth spin relaxation time when approaching Tsub(M) from above which differs sharply from previous results on $DyAl_3$. A clear signal could be obtained for amorphous DyAg only around 300K. It indicates that the distribution of local fields at the μ-site is not significantly different in the crystalline and amorphous compounds.

44583 (CEA-CONF—7452) μSR-studies of magnetic properties of metallic rare earth compounds. Asch, L.; Kalvius, G.M.; Chappert, J.; Yaouanc, A.; Hartmann, O.; Karlsson, E.; Wappling, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1984. 41p. (CONF-8409102—9). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752073.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

Positive muons can probe the magnitude and the time dependence of the magnetic field at interstitial sites in condensed matter. Thus the relatively new techniques of muons spin rotation and muon spin relaxation have become unique tools for studying magnetism. After a brief introduction into the experimental method we then discuss measurements on the elemental rare earth metals and on intermetallic compounds, in particular on the cubic Laves phases $REAl_2$.

44584 (CEA-CONF—7507) Elastic-plastic waves in UV 0.2 Uranium alloy. Bernier, H.; Lalle, P. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1984. 5p. (CONF-8409145—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752078.

From International colloquium on the physics and physicochemistry of highly condensed matter; Aussois, France (11 Sep 1984).

Release waves coming from the back face of an uranium alloy projectile in a symmetric collision are used to estimate some dynamic characteristics of this material. In the pressure range experimentally covered (<=29GPa) the velocity of the elastic precursor is about 3,45 km/s, and the Hugoniot elastic limit (HEL) is 1,15GPa. The pressure decrease behind the 20GPa (29GPa) shock wave begins with a quasi-elastic wave which velocity is 3,9 km/s (4,2 km/s), and pressure jump of 3GPa (3,7GPa).

44585 (CEA-CONF—7511) Zirconium fabrication and junction between zirconium or titanium and stainless steel. Decours, J.; Demay, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1984. 33p. (In French). (CONF-841009—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781586.

From 4. symposium on titanium and zirconium in industrial applications; Philadelphia, PA, USA (10 Oct 1984).

The realization of some equipment for spent fuel reprocessing plants requires the use of zirconium because of its corrosion resistance to nitric media. In this paper are treated: problems met in zirconium forming from industrial products, welding of large parts outside a glovebox, joining with austenitic stainless steel pipes.

44586 (CEA-CONF—7523) Phase stability under irradiation. Barbu, A.; Martin, G.; Limoge, Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 27 Nov 1984. 26p. (CONF-840928—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752058.

From 12. summer school and symposium on the physics of ionized gases; Sibenik, Yugoslavia (3 Sep 1984).

Experimental evidences of radiation induced instability are described then it is shown what theoretical approaches are relevant. Radiation induced segregation and precipitation in alloys irradiated at constant chemical composition, precipitate re-solution, order-disorder transition under irradiation and amorphization are examined.

44587 (CEA-R—5277) Experimental study on the adiabatic shear bands. Affouard, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Jul 1984. 160p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85751196.

Four martensitic steels (Z50CDV5 steel, 28CND8 steel, 35NCDV16 steel and 4340 steel) with different hardness between 190 and 600 Hsub(B) (Brinell hardness), have been studied by means of dynamic compressive tests on split Hopkinson pressure bar. Microscopic observations show that the fracture are associated to the development of adiabatic shear bands (except 4340 steel with 190 Hsub(B) hardness). By means of tests for which the deformation is stopped at predetermined levels, the measurement of shear and hardness inside the band and the matrix indicates the chronology of this phenomenon: first the localization of shear, followed by the formation of adiabatic shear band and ultimatly crack initiation and propagation. These results correlated with few simulations by finite elements have permitted to suggest two mecanisms of deformation leading to the formation of adiabatic shear bands in this specific test.

44588 (CONF-840978—5) TEM studies of crack tip deformation in bcc molybdenum at low temperatures. Park, C.G.; Ohr, S.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017087.

From International symposium on high temperature corrosion in energy systems; Detroit, MI, USA (17 Sep 1984).

Electron microscope studies have been made of the slip systems that are activated at the crack tip in bcc molybdenum during in situ tensile deformation at various temperatures (100 ~ 300°K). At ambient temperature, all three modes of crack tip deformation have been observed under an applied stress. Dislocations are emitted from the tips of propagating cracks, pass rapidly through a dislocation-free zone (DFZ) and pile up in a plastic zone. The observed crack tip slip systems were analyzed in terms of the crack tip Schmid factor obtained from the resolved shear stress modified by the presence of a crack. Results show that crack tip deformation occurs by the emission of dislocations from the crack tip, and that the shear crack of mode III is most prevalent mode. Therefore, the choice of slip system is primarily dictated by the crack tip Schmid factor, along with the critical stress intensity factor for dislocation emission from the crack tip. The temperature dependence of crack tip deformation and its relationship to the ductile-brittle transition have also been examined. The slip systems possessing the maximum crack tip Schmid factors are usually activated from the crack tip at temperatures above 150°K. At temperatures below 140°K, a brittle crack (cleavage) is preceded by mixed mode crack tip deformation, although the extent of the deformation is markedly reduced. The ductile-brittle transition of the fracture mode observed in the electron microscope agreed well with the mechanical behavior of the metal observed from bulk tensile tests performed at low temperatures.

44589 (CONF-850788—1) TEM-APFIM investigation of boron-doped Ni_3Al. Horton, J.A.; Miller, M.K. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017154.

From 32. international field emission symposium; Wheeling, WV, USA (15 Jul 1985).

Boron additions to normally brittle Ni_3Al result in room temperature ductilities over 50%. Little is presently known about the role of boron in strengthening the otherwise brittle grain boundaries. A TEM structural characterization of cast material shows a featureless microstructure while rapidly solidified material has substantial aluminum enrichments coupled with a bimodal APB distribution. Preliminary atom probe investigations of cast material found the boron in solution, with no evidence of clustering in the grain interiors. A small enrichment of boron was found at twin boundaries.

44590 (CONF-850840—11) Segregation to boundaries in an antimony-containing stainless steel. Kenik, E.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016587.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

The mechanical strength and local chemical properties of alloys are often determined by the presence of grain boundaries in the material. Degradation of these properties is often associated with segregation of arsenic, phosphorus, and other elements to the boundaries. The presence of antimony results in a threefold decrease in the fracture elongation and a threefold increase in the density of intergranular cracks formed during creep deformation. High spatial resolution energy dispersive x-ray spectroscopy (EDXS) was utilized to measure segregation to a variety of boundaries in several aged materials.

44591 (CONF-850871—4-Draft) Spin dynamics of a Cu-Mn spin glass alloy. Cable, J.W.; Nicklow, R.M.; Tsunoda, Y. (Oak Ridge National Lab., TN (USA); Osaka Univ. (Japan)). Jul 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016295.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

Inelastic neutron scattering measurements were made on Cu-Mn spin-glass alloys to compare the spin dynamics associated with the ferromagnetic and antiferromagnetic spin-pair correlations present in these alloys. These correlations give rise to elastic diffuse peaks at Q = (1, 1/2, 0) and 1, 1/2+-δ, 0), respectively. Constant-Q measurements on Cu-10% Mn and Cu-21% Mn at 295°K yield the same inverse relaxation times at these two positions in Q. These results indicate that composite ferro-antiferromagnetic clusters exist both above and below T/sub f/ and fluctuate in time while maintaining their spatial correlations.

44592 (CONF-850890—13) Paramagnetic form factors of HCP transition metals. Liu, S.H.; Liu, A.J.; Cooke, J.F. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016301.

From International conference on magnetism; San Francisco, CA, USA (26 Aug 1985).

Elastic neutron scattering experiments have provided accurate information about the Fourier transform of the total induced magnetizaion density which consists of orbital and spin contributions. Traditionally, one analyzes the orbital part by using the atomic model. Recently we have developed a numerical technique to compute accurately the orbital moment form factor of the itinerant electrons in cubic transition metals. We have now extended the calculation to hcp metals Sc, Y, Lu, and Zr. The calculated orbital contributions deviate from atomic orbital form factors. There is reasonable overall agreement between theory and experiments.

44593 (CONF-850890—14) Temperature dependence of the magnetic excitations in Gd. Cable, J.W.; Nicklow, R.M.; Wakabayashi, N. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016303.

From International conference on magnetism; San Francisco, CA, USA (26 Aug 1985).

Magnetic excitation spectra were measured for Gd in the <OOl> and <hhO> directions over the temperature range from 9 to 320°K (T/sub c/ = 292.7°K). Spin-wave-like modes are observed at T ≅ T/sub c/. The critical wavevector for the appear-

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ance of these modes is proportional to the inverse correlation length.

44594 **(CONF-850890—15) First-principles calculation of the magnetic properties of paramagnetic fcc iron.** Johnson, D.D.; Gyorffy, B.L.; Pinski, F.J.; Staunton, J.; Stocks, G.M. (Oak Ridge National Lab., TN (USA); Bristol Univ. (UK). H.H. Wills Physics Lab.; Cincinnati Univ., OH (USA). Dept. of Physics; Warwick Univ., Coventry (UK). Dept. of Physics). 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017155.

From International conference on magnetism; San Francisco, CA, USA (26 Aug 1985).

Using the disordered local moment picture of itinerant magnetism, we present calculations of the temperature and volume dependence of the magnetic moment and spin-spin correlations for fcc Fe in the paramagnetic state. These calculations are based on the parameter-free, first principles approach of local spin density functional theory and the coherent potential approximation is used to treat the disorder associated with the random orientation of the local moments.

44595 **(CONF-850902—1) Role of hydrogen embrittlement in intergranular stress corrosion cracking of sensitized Type 304 stainless steel.** Ruther, W.E.; Kassner, T.F.; Nichols, F.A. (Argonne National Lab., IL (USA)). Jun 1985. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01 - GPO. File Number TI85014965.

From 2. international symposium on environmental degradation of materials in nuclear power systems--water reactors; Monterey, CA, USA (9 Sep 1985).

Fixed-load Mode I/Mode III comparative tests have been conducted on lightly sensitized (EPR = 2 C/cm²) Type 304 SS specimens in 289°C oxygenated water with other impurity additives. Substantial susceptibility to IGSCC was shown in Mode I but no conclusive evidence for SCC was found in Mode III. These results are consistent with a hydrogen embrittlement mechanism of crack advance, but electrochemical measurements seem to accord better with a slip-dissolution mechanism. Further studies are needed to clarify the operative mechanism(s).

44596 **(CONF-8504115—5) Itinerant f-electron behavior in Ce and U compounds.** Crabtree, G.W. (Argonne National Lab., IL (USA)). Apr 1985. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014961.

From 5. international conference on crystalline field effects in f-electron systems: ICCF5; Sendai, Japan (15 Apr 1985).

The experimentally observed Fermi surface properties in URh_3, UIr_3, UGe_3, $CeSn_3$, CeB_6, U_3As_4, U_3P_4, and CeSb are reviewed. For the compounds with no magnetic order, band structure models of the Fermi surface geometry are confirmed and f-ligand hybridization is found to be dominant. For CeB_6, U_3As_4, and U_3P_4 the experiments show that both local moments and f hybridization are important. In CeSb new data can be explained by a purely local model with no f-hybridization.

44597 **(CONF-8506165—2) Effect of pulsed irradiation on microstructural evolution.** Packan, N.H. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016317.

From Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions; Ebeltoft, Denmark (27 Jun 1985).

Discontinuous irradiation, such as could ensue from the operation of a magnetic fusion reactor, may cause changes in the development of radiation damage microstructures. In this paper, the experimental observations of such pulsing effects are collected and compared. Resulting trends are related to the implications of theoretical mechanisms. Conclusions are drawn on the degree to which pulsing seems capable of affecting the major aspects of radiation damage to metals.

44598 **(DOE/ER/10956—18) Diffraction and microscopy studies of the structure of grain boundaries in Fe, Fe-base alloys and ceramic materials. Final technical report.** Sass, S.L. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Aug 1985. Contract AC02-81ER10956. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016950.

The long range goal of this research project has been to obtain information on the atomic structure of grain boundaries in bcc metals and ceramics, to understand how segregation influences grain boundary structure and causes boundaries to become embrittled in Fe-base alloys, to understand how segregation and the ionization state of the solute influences the boundary structure in ceramic materials, and to study faceting and the frequency of its occurrence in ceramic materials. Electron microscopy and electron diffraction techniques were used to carry out the studies on grain boundaries. The research progress made during the support period of the contract is reviewed.

44599 **(DOE/ER/45116—6) Test for a possible "melting" transition in grain boundaries in aluminum near the melting point.** Chan, S.W.; Liu, J.S.; Balluffi, R.W. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). Jul 1985. Contract FG02-84ER45116. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013238.

Results indicate that the near-Σ5 <100> twist and tilt boundaries did not undergo melting at temperatures as high as (0.89 +- 0.03) T/sub m/ and (0.92 +- 0.03) T/sub m/, respectively. This result appears to be in disagreement with the calculated grain boundary melting transitions at lower values of T/T/sub m/. Our results are not inconsistent with calculations which suggest that a type of disordering may occur in which the boundary becomes highly defective locally while still retaining its basic crystallinity. Also, our work seems consistent with the experimental results in which the rotating crystallite method was used to demonstrate that at least many boundaries in copper remain ordered to temperatures as high as 0.97 T/sub m/. The cause of the grain boundary splitting phenomenon observed for the tilt boundaries near 0.94 T/sub m/ is not completely clear. The observation of the lattice dislocation activity in the adjoining crystals suggests that stresses were present which may have caused simple fracture at the boundaries. On the other hand, the authors cannot preclude the more complex possibility that some structural change occurred at these boundaries which played an essential role in the splitting.

44600 **(DOE/OR/21400—T168) Hydrogen attack in Cr-Mo steels at elevated temperatures. Final technical report, September 1, 1980-August 31, 1983.** Stone, D.; Su, Z.J.; Ruoff, S.; Wanagel, J.; Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). 1983. Contract AC05-84OR21400. 243p. (CU/MSE—07963-01). NTIS, PC A11/MF A01; GPO Dep. File Number DE85016177.

An important objective of this work is to characterize the kinetics of methane bubble nucleation and growth during hydrogen attack in the 2.25 Cr-1.0 Mo steels. The knowledge of these kinetics is required in generating the capabilities for predicting the evolution of the numbers and size distributions of methane bubbles in the steels as functions of time during hydrogen exposure at elevated temperatures and pressures. An understanding of the processes behind hydrogen attack will aid in establishing a scientific basis for the Nelson curves (4) and developing better alloys for service under high-temperature, high-pressure hydrogen. This report contains seven chapters. The second chapter is a brief literature review of the phenomenon of hydrogen attack in steels. It discusses some of the variables that influence hydrogen attack. The third chapter describes the experimental objectives and procedures of the present work. The results of these experiments are described and discussed in the fourth chapter. The fifth chapter discusses some of the analytical models found in the literature that describe bubble or cavity nucleation and growth under internal pressure or externally applied stress. Also in chapter five, these models are adapted to describe the hydrogen attack phenomenon. In chapter six the models are used to interpret the data obtained here and found in the literature.

Chapter seven contains the conclusions drawn from this work. It describes how the information may be used in technological applications and suggests areas for future study. 70 refs., 39 figs., 8 tabs.

44601 **(DTH-ABK-S—19) Fatigue testing of adhesive bonding between steel and glass-fiber reinforced polyester. Report until December 1982.** (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner). 1983. 21p. (In Danish). Denmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner.

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Glass-fiber reinforced polyester used as a blade material in windmills was tested mechanically. The adhesion bonding between polyester and steel was investigated for several adhesion methods, temperatures fatigue, break etc.

44602 **(FEI—1529) Investigation into fields of oxygen thermodynamic activity in a sodium-potassium coolant by emf method.** Ivanovskij, M.N.; Kuznetsova, L.M.; Morozov, V.A.; Shimkevich, A.L.; Shmatko, B.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701863.

The emf method employing two electrochemical sensors placed in different parts of nonisothermal circulation circuit has been applied to investigate the oxygen activity fields in a sodium-potassium coolant. It is established that, in the process of purification of the eutectic alloy from oxygen (10 to 0.1 pp) by a cold trap, isoconcentrational distribution of this admixture over the circuit length remains.

44603 **(HEDL—7455-Rev.1) Zircaloy cladding corrosion degradation in a tuff repository. Initial experimental plan. Revision 1.** Smith, H.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1985. Contract AC06-76FF02170. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016933.

The potential for degradation or corrosion of spent fuel cladding in a tuff repository is examined, and an initial experimental plan to determine corrosion mechanisms and to estimate long-term corrosion rates is presented. The environmental history of a tuff repository at Yucca Mountain is evaluated for the potentially most severe corrosion conditions for Zircaloy spent fuel cladding. In two of the three distinct periods identified, liquid water can be present. An overview of the corrosion characteristics of zirconium and its alloys indicates that conditions in which liquid water is present should be the most corrosive conditions for spent fuel cladding. The experimental program will model the chemical, physical and geometrical aspects of spent fuel disposal as precisely as possible. The corrosion specimens will be examined by standard techniques such as optical microscopy and SEM and by state-of-the-art techniques such as using the STEM in a SEM mode to achieve much higher resolution that normally obtained with a standard SEM. A key aspect is the comparative examination that will be needed to help establish mechanisms and estimate or bound low corrosion rates. This plan presents an initial program schedule for these studies, as well as proposed schedules for the future. It also spells out what information will be provided in reports, starting at the end of FY 1985. 46 refs., 9 figs., 6 tabs.

44604 **(INIS-mf—9323) Development of material laws for high-temperature plasticity.** Steck, E. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Allgemeine Mechanik und Festigkeitslehre). (Gesellschaft fuer Mathematische Forschung e.V., Oberwolfach (Germany, F.R.). Mathematisches Forschungsinstitut). 1983. 31p. (In German). (CONF-830188—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781555.

From Conference on continuum mechanics of solids; Oberwolfach, F.R. Germany (2 Jan 1983).

High temperature plasticity of metals at temperatures >0.5* melting temperature is, at least for stress ranges of technical interest, explained by thermally activated dislocation movements, where the 'structure' of the material, i.e. distribution and strength of the internal barriers, which act against these movements, are of strong influence on these processes. The characterization of this structure by transition probabilities of a discrete Markov-chain results in a stochastic model which is able to represent essential and typical features which are characteristic for high temperature plasticity, such as stationary creep, dependence of the internal structure on stress and temperature or transition times to stationary creep after changes of these loads, in an at least qualitatively satisfactory manner, and which allows for an examination of the effects of assumptions about the deformation mechanisms on the microscale.

44605 (INIS-mf—9714, pp 13-14) **Angle dependence of the adsorption- and desorption probabilities of gases.** Rendulic, K.D.; Winkler, A.; Steinrueck, H.P. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). Nov 1984. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781213.

Published in summary form only.

In Progress report 1983/1984 of the Solid State Institute of the Technical University of Graz.

44606 (INIS-mf—9714, pp 12-13) **Analysis of first atom-layer of alloy surfaces.** Rendulic, K.D.; Leisch, M.; Reinmueller, H. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). Nov 1984. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781213.

Published in summary form only.

In Progress report 1983/1984 of the Solid State Institute of the Technical University of Graz.

44607 **(INIS-mf—9751) Moessbauer isomer shift in intermetallic compounds of europium and gadolinium.** Vries, J.W.C. de. (Rijksuniversiteit Leiden (Netherlands)). 8 Nov 1984. 111p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781553.

Includes Dutch summary; 101 refs.; 53 figs.; 32 tabs.

In the past years a semi-empirical model has become known which serves to clarify the redistribution of electronic charge when two elements are brought together to form a compound or an alloy: the atomic cell model. Also the Moessbauer isomer shift can be evaluated in terms of two quantities related to this model sign and absolute value of the enthalpy of formation in binary alloys. This model is applied to the isomer shift of ^{155}Gd in Eu-base intermetallics. The Moessbauer effect is described first and the rare earth isotopes ^{151}Eu and ^{155}Gd are considered. The experimental arrangement is described. The atomic cell model is briefly dealt with. Finally, the results of experiments on the ^{155}Gd and the ^{151}Eu compounds are presented.

44608 **(IS-M—541) Rare earth chemical and physical metallurgy.** Gschneidner, K.A. Jr. (Ames Lab., IA (USA)). 1985. Contract W-7405-ENG-82. 6p. (CONF-8509133—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015536.

From International conference on rare earth-development and applications; Beijing, China (10 Sep 1985).

The current state of the rare earth field is reviewed in the areas of basic research, applied research and technology, and commercial utilization. The role of China and its influence, as viewed by an outsider, is briefly summarized. The final third of the paper deals with one aspect of the author's research interests - the quenching of spin fluctuations in exchange enhanced paramagnets.

44609 (IWGFR—49-Vol.2, pp 455-476) **Effects of microstructure on the temper embrittlement susceptibility of a 2 1/4Cr1Mo forging.** Gage, G.; Edwards, B.C.; Hudson, J.A. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

This paper describes the results of a detailed metallurgical assessment of the microstructural stability and temper embrittlement susceptibility of a 255mm thick 2 1/4Cr1Mo steel forging which was manufactured by a process typical of that used for the tube plates of steam generator units. Ageing effects were studied over

the temperature range 450-575 deg. C for times up to 20,000h. Grain boundary compositional changes were monitored using Auger Electron Spectroscopy (AES) and microstructural changes determined by both transmission electron microscopy and X-ray analysis. Brittle intergranular failure was produced in the lower shelf energy regime and AES analysis showed that this was associated with the grain boundary segregation of phosphorus. This segregation was shown to exhibit equilibrium characteristics and was consistent with that of phosphorus segregation in α-iron. Implying no significant alloy-impurity interaction. The shift in the ductile-to-brittle transition temperature was not uniquely a function of the grain boundary segregation but was shown to be dependent upon both the level of grain boundary solute segregation and the type of precipitate particles present. Heat treatment conditions which promoted the formation of M_6C precipitates were particularly deleterious to toughness.

44610 (IWGFR—49-Vol.2, pp 477-501) **Stress relief cracking studies of 2 1/4Cr1Mo steel.** Hippsley, C.A.; Edwards, B.C. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The stress relief cracking susceptibility of coarse grained heat-affected-zone microstructures of 2 1/4Cr1Mo steel has been assessed using a recently developed constant displacement stress relief cracking test procedure. Two types of test are described: the "relaxation test" which simulates conditions of stress, strain and temperature during the post weld heat treatment cycle, and the "load shedding" test which characterises crack growth behaviour in terms of the stress intensity parameter at constant temperatures in the stress relief thermal cycle. Particular attention has been directed at characterising the micromechanisms of cracking and the role of residual impurities. Two distinct types of stress relief cracking were identified: failure at high temperatures, >875K, was characterised by intergranular ductile microvoid coalescence, whereas at lower temperatures, 725K-875K, a low ductility intergranular failure was produced with the cracking promoted by solute segregation to the grain boundaries and the crack tip region. An increase in the heating rate during the post weld heat treatment was shown to be beneficial to cracking resistance. The application of the laboratory test data to the prediction of stress relief cracking of actual weldments is considered, using two alternative methods.

44611 (IWGFR—49-Vol.2, pp 503-516) **Comparison of low-cycle fatigue data of 2 1/4%CrMo steels.** Sanderson, S.J. (UKAEA Risley Nuclear Power Development Labs.); Breuer, H.J. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Petrequin, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Nieuwland, H.C.D. (Neratoom N.V., The Hague (Netherlands)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Data files have been produced on international strain-controlled fatigue information available for 2 1/4%CrMo steels; data assessment from these files is treated in three categories viz: annealed and isothermally annealed 2 1/4%Cr1%Mo steel; normalised and tempered and quenched and tempered 2 1/4%Cr1%Mo steel; and 2 1/4%CrMo variants. The available data have been considered generally in terms of total strain range vs. cycles to failure (Nsub(f)), tensile stress at Nsub(f)/2 vs. cycles to failure and time to failure vs. cycles to failure. Where possible the continuous cycling data have been statistically analysed in terms of the elastic and plastic strain components and cycles to failure to yield best-fit equations over defined temperature (T) regimes viz: T <= 427 deg. C, 427 deg. C < T <= 550 deg. C. and 550 deg. C < T <= 600 deg. C. The behaviour of the steels within the various classifications is discussed.

44612 (IWGFR—49-Vol.2, pp 519-544) **Impact and hot tensile properties of 9Cr1Mo steel in various heat treatment conditions.** Fidler, R.S. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.); Middleton, C.J. (Central Electricity Research Labs., Leatherhead (UK)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The impact and elevated temperature tensile properties of 9Cr1Mo in several heat treatment conditions have been studied to test the tolerance of the steel to departures from the material specification for AGR or fast reactor applications. The properties were found not to be sensitive to grain size or to the presence of grain boundary delta ferrite (<5%) which can arise in weld heat affected zones. Prior creep resulted in some loss of tensile strength but no loss of ductility was measured even though secondary precipitation had begun to develop under the conditions of the prior creep test. The dominant variable governing both tensile and impact properties was the state of temper and an empirical relationship was found between the tensile properties and hardness: the latter also being predictable by a Holloman-Jaffe form of expression. However, the Charpy impact properties of specimens aged near the service temperature (at 550 deg. C) were severely reduced by a mode of prior austenite grain boundary embrittlement manifested as severe intercrystalline failure. The embrittlement is of a type consistent with decohesion arising simply from equilibrium segregation (ie temper embrittlement). While the latter appears to make a significant contribution, interface decohesion is believed also to depend on concentration changes associated with carbide growth.

44613 (IWGFR—49-Vol.2, pp 545-577) **Thermal ageing studies of 9%Cr 1%Mo steel.** Wall, M.; Edwards, B.C.; Hudson, J.A. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The effects of thermal ageing on the tensile and impact properties of a commercial 9%Cr 1%Mo steel, in a quenched and tempered condition, have been studied. The corresponding grain boundary compositional changes were monitored using Auger Electron Spectroscopy (AES) and microstructural changes monitored using transmission electron microscopy. Ageing at 500 deg. - 550 deg. C produced a degradation in the impact properties which was characterised by a progressive increase in the ductile to brittle transition temperature, a decrease in the upper shelf energy and the promotion of intergranular fracture in both upper and lower shelf energy regimes. Partial intergranular fracture was observed throughout the upper shelf to temperatures of +400 deg. C. AES showed that the degradation in properties was associated with the grain boundary segregation of trace impurities and a bimodal distribution of segregation was determined. Complementary transmission electron microscopy studies showed significant microstructural changes were occurring during thermal ageing and in particular the formation of Laves phase was noted at the lath and grain boundaries. The degradation observed in impact properties was not necessarily reflected in room temperature tensile tests, which were sensitive to grain boundary segregation effects only over a narrow ageing regime. This behaviour was explained in terms of fine scale matrix precipitation followed by particle coarsening.

44614 (IWGFR—49-Vol.2, pp 579-599) **Some aspects of the creep and fracture properties of intercritically annealed 9Cr1Mo.** Soo, J.N. (Central Electricity Research Labs., Leatherhead (UK). Materials Div.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The region of the 9Cr1Mo heat affected zone where the peak welding temperature is below that for complete $\alpha \rightarrow \gamma$ transformation (A_3) forms a fine grained (<ASTM 12) ferritic structure, the intercritically annealed zone (ICAZ). Under certain stress and temperature regimes this zone has a lower creep strength than the

unaffected parent metal with a fracture mode similar to that in alloys which cavitate during 'superplastic' deformation. Furnace heating was successful in simulating the fine grained microstructure uniformly in test pieces. The simulated microstructure had a stress dependence of 2 for the minimum creep rate which was consistent with a predominantly grain boundary sliding deformation mechanism, and a cavitation failure mode similar to that in weld intercritically annealed heat affected zones.

44615 (IWGFR—49-Vol.2, pp 601-612) **Some elevated temperature tensile and strain-controlled fatigue properties for a 9%Cr1Mo steel heat treated to simulate thick section material.** Sanderson, S.J.; Jacques, S. (UKAEA Risley Nuclear Power Development Labs.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Current interest has been expressed in the usage of thick section 9%Cr1%Mo steel, particularly for UK Commercial Demonstration Fast Reactor (CDFR) steam generator tube plates. This paper presents the results of some preliminary mechanical property test work on a single cast of the steel, heat treated to simulate heavy ruling sections encompassing thicknesses likely to be met in the CDFR context. The microstructures of the simulated thick section material were found to remain predominantly as tempered martensite even at the slowest transformation cooling rates used (50 deg. C/h). The effect of microstructure is reflected in the elevated temperature proof stress, tensile strength and strain-controlled fatigue endurance which were found to be comparable with the properties established for thin section normalised and tempered 9%Cr1%Mo steel. These results are extremely encouraging and, taken in conjunction with the results from other simulation work on this material, further demonstrate the potential of thick section 9%Cr1%Mo steel.

44616 (IWGFR—49-Vol.2, pp 613-625) **Effects of sodium environment on the mechanical properties of Fe-2 1/4Cr-1Mo steel.** Chopra, O.K. (Materials Science and Technology Div., Argonne National Lab., IL (USA)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Mechanical property data on isothermally annealed, thermally aged, and sodium-exposed Fe-2 1/4Cr-1Mo steel are analyzed to evaluate the influence of the sodium environment as well as the effects of the microstructural and compositional changes that occur in the steel during long-term exposure to sodium. Correlations are developed to predict the environmental effects on tensile, creep, fatigue, and creep-fatigue properties of Fe-2 1/4Cr-1Mo steel in sodium. The results indicate that at temperatures <823 K (550 deg. C), degradation of mechanical properties is essentially due to thermal aging. Loss of carbon from the steel reduces both the tensile and creep-rupture strength, but has little or no effect on the fatigue properties. The cyclic properties of Fe-2 1/4Cr-1Mo steel in sodium are superior to those in air. The creep-fatigue behaviour in sodium is significantly different from that in an air environment. The creep-fatigue data are analyzed using the interactive damage rate equations to predict the time-dependent fatigue bahaviour of isothermally annealed Fe-2 1/4Cr-1Mo steel in sodium.

44617 (IWGFR—49-Vol.2, pp 627-644) **Influence of flowing sodium on creep rupture properties of type 316 and 9Cr1Mo steels.** Horton, C.A.P. (Central Electricity Research Labs., Leatherhead (UK)); Fidler, R.S. (Marchwood Engineering Lab., Southhampton (UK)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Creep rupture tests in flowing sodium are underway in the CEGB sodium loop facility at MEL. The loop, constructed in Type 316 stainless steel, provides eight test points in parallel, each fed with flowing sodium of the same controlled purity and at temperatures up to 625 deg. C. Specimen strain is continuously monitored throughout each test. Results of a test series on Type 316 and 9Cr1Mo steels in their "standard" states, ie solution treated and normalised and tempered respectively, have shown no deleterious effects of sodium on the creep rupture behaviours. Surface cracking, which occurs during in-air tests on Type 316 steel, was less extensive in the sodium tests and was associated with slight increases in rupture elongations. With 9Cr1Mo steel there was no surface cracking and no significant differences between in-sodium and in-air behaviours.

44618 (IWGFR—49-Vol.2, pp 645-671) **Influence of sodium on the creep-rupture behaviour of steel-X6CRNI1811 (Type 304 SS) at 823 K.** Huthmann, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Borgstedt, H.U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Uniaxial creep-rupture tests were performed on the base material and on welded joints of X6CrNi1811 material (similar to Type 304 SS) at 823 K (550 deg. C) in air and in the non-isothermal sodium loops at INTERATOM and KfK. The results for the base material and welded joints show that the sodium environment reduces the time to rupture, which is essentially caused by a reduced ductility within the region of tertiary creep. Minimum creep rate and time to onset of tertiary creep are not influenced by the sodium environment. Fractographic observations show a more brittle behaviour of the specimens tested in sodium with deeper intergranular cracks starting from the surface of the specimen. In the welded joints the cracks leading to fracture develop in the heat affected zone of the base material. The weld metal itself does not represent a weak point as regards sodium influence.

44619 (IWGFR—49-Vol.2, pp 673-679) **UKAEA stress rupture results from tests performed in sodium.** Wood, D.S.; Prince, D.H.C.; Wynn, J. (UKAEA Risley Nuclear Power Development Labs.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The UKAEA is involved in stress rupture tests in sodium. Stress rupture tests of up to 15,000h in static sodium and 10,000h in dynamic sodium have been performed on N+T 9%Cr1%Mo steel and on Type 316 steel. Small differences in strength, generally $<5\%$ have been observed relative to air data. Differences of this magnitude could be due to absolute temperature uncertainties related to thermocouple response; this aspect is being investigated. Sodium does not appear to be deleterious to the stress rupture ductility, and may be slightly beneficial.

44620 (IWGFR—49-Vol.2, pp 683-700) **Low and high cycle fatigue behaviour of steel-X6CRNI1811 (Type 304 SS) in air and flowing sodium.** Huthmann, H.; Jenner, G. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Strain controlled LCF-tests were performed on X6CrNi1811 steel (Type 304 SS) in air and flowing sodium in a non-isothermal sodium loop. The results measured at 550 deg. C in an upstream position of the sodium loop show an increase in fatigue life in the strain range from about 1.5% to 0.4% for the base material in the as-received condition while the welded joints remain unaffected by the environment. The LCF-behaviour of base material specimens tested at 500 deg. C in a downstream position after a prior pre-exposure to sodium (4058 h, 500 deg. C) is also improved in comparison to parallel specimens tested in air with comparable thermal aging. Load controlled HCF-tests performed on X6CrNi1811 steel at 550 deg. C show a significant increase in fatigue life in the low cycle region (Nsub(f) $< 10^6$ cycles) and a higher endurance limit for the base material in sodium but no influence of the environment is indicated for the welded joints.

44621 (IWGFR—49-Vol.2, pp 701-709) **Creep/fatigue behaviour of Type 316 steel in sodium.** Wood, D.W.; Baldwin, A.B. (UKAEA Risley Nuclear Power Development Labs.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Continuous cycling fatigue tests at a temperature of 625 deg. C and strain ranges of 0.5 to 1.5% gave endurances in high purity sodium up to five times greater than in air. Creep/fatigue test of up to 2000h duration at strain ranges of about 1% and temperatures of 550 and 625 deg. C showed endurances similar to those from air tests. It is concluded that the design of components to be operated in high purity sodium can be based on air fatigue and creep/fatigue data.

44622 (IWGFR—49-Vol.2, pp 711-740) **Fatigue and creep crack growth behaviour of steel-X6CRNI1811 (Type 304 SS) in air and flowing sodium.** Huthmann, H.; Gossmann, O. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Safety analysis and operation support of LMFBRs require knowledge of the crack growth properties of reactor structural materials in air and ambient environment at elevated temperatures. Therefore, in this work the fatigue and creep crack growth behaviour of the steel-X6CrNi1811 in air and flowing sodium at 823 K is presented. The fatigue crack growth tests have been performed on the base material and the creep crack growth tests on base material and welded joints, too. The sodium conditions are characterized by an upstream position in a non-isothermal loop with a temperature gradient of 170 K. The comparison of crack growth rates in air and sodium measured on the same heat and the same specimen geometry (CT-specimen) reveal no influence of environment.

44623 (IWGFR—49-Vol.2, pp 741-753) **Low-cycle fatigue properties of SUS304 stainless steel in high-temperature sodium.** Hirano, M.; Komine, R.; Kitao, K.; Nihei, I.; Yoshitoshi, A. (Sodium Technology and Materials Section, FBR Systems and Components Div., Power Reactor and Nuclear Fuel Development Corp. (Japan)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Low-cycle fatigue tests in sodium and in air have been performed to investigate the influence of a high-temperature sodium environment on the strain-controlled fatigue behaviour for SUS304 stainless steel. The oxygen concentration in sodium was 2.4 ppm at the cold trap temperature of 145 deg. C. Tests in both environments were conducted at 450 deg. C, 550 deg. C and 650 deg. C at a constant strain rate of 1×10^{-3}/sec with a fully-reversed triangular waveform and a zero mean strain. The fatigue life of SUS304 stainless steel in sodium at 450 deg. C, 550 deg. C and 650 deg. C was greater than those in air at the same temperature except at higher strain range (>0.8%) at 650 deg. C, and this difference had a tendency to increase as the total strain range decreases. At the higher total strain range at 650 deg. C, there was no marked difference between both environments. As the temperature increased, the fatigue life in sodium and in air decreased, and the Nsub(f sodium)/Nsub(f air) ratio also decreased. Microscopic examination of specimens tested in sodium and in air at 450 deg. C, 550 deg. C and 650 deg. C revealed no difference in the microstructure, but few surface cracks were observed on specimens tested in sodium than in those tested in air. Fractography of specimens tested in air at 450 deg. C, 550 deg. C and 650 deg. C revealed well-defined striations. But, in sodium, striations on specimens tested at 450 deg. C and 550 deg. C showed obscure configuration and it was difficult to find out, whereas, at 650 deg. C in sodium intergranular fracture was observed. The specimens tested in sodium had a longer fatigue life than those tested in air because the latter are subjected to considerable oxidation, while the former are free of such chemical action. Accordingly, it is concluded that crack initiation and propagation are more likely to occur in air than in sodium.

44624 (IWGFR—49-Vol.2, pp 915-937) **Fracture toughness of Type 316 steel and weld metal.** Picker, C. (UKAEA Risley Nuclear Power Development Labs.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

This paper describes the results of fracture toughness tests on Type 316 steel and Manual Metal Arc (MMA) weld metal over a range of temperatures from 20 deg. C to 550 deg. C, and includes the effects on toughness of specimen size, post weld heat treatment and thermal ageing. The conclusions reached are that Type 316 steel possesses a superior toughness to the weld metal in the as-welded or stress relieved conditions but the toughness of the steel is degraded to a level similar to that of the weld metal following thermal ageing at temperatures over 600 deg. C. Relatively short term thermal ageing in the temperature range 370 deg. C to 450 deg. C does not appear to affect the toughness of either Type 316 steel or weld metal.

44625 (IWGFR—49-Vol.2, pp 975-1008) **New approach for stress rupture data extrapolation.** Bocek, M. (Kernforschungszentrum Karlsruhe GmbH. Inst. fuer Material- und Festkoerperforschung 2 (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The common feature of stress rupture lines in the usual log σ/log tsub(f) - plot is that their curvature is always $d^2\log \sigma / d(\log tsub(f))^2 < 0$. Hence, a linear extrapolation from these graphs leads to non-conservative estimates. In the present investigation it is shown that stress rupture functions $F(\sigma, tsub(f))$ can be derived which are more suitable for life time extrapolations as the usual one mentioned above. Best results were obtained with a function of the type tsub(f) approx. sinh $\beta\sigma$. Besides a better extrapolation, the functions examined allow a better understanding about the nature of the life time determining mechanisms. The new method is applied to stress rupture data of SS AISI 304.

44626 (IWGFR—49-Vol.2, pp 1009-1018) **Analytical method on evaluation of creep-fatigue life with long-time strain hold.** Wada, Y.; Nihei, I.; Yoshitoshi, A. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Evaluation of creep-fatigue life with long-time strain hold is a very important problem for structural design of FBR. But, these creep-fatigue tests are very difficult because of test techniques and costs. Therefore, the life prediction for long-time must be based on analytical approach by which the extrapolation to the range of longer hold time effect can be evaluated and justified. In this paper, an analytical method is proposed, which is based on generalized relaxation analysis, creep damage analysis, total damage evaluation per cycle and the diagram of creep-fatigue interaction effect. By this method, it is expected that the prediction is simplified and the evaluation is conservative.

44627 (IWGFR—49-Vol.2, pp 1035-1063) **Analytical description of high temperature tensile creep for cavitating materials subjected to time variable loads.** Bocek, M. (Kernforschungszentrum Karlsruhe GmbH. Inst. fuer Material- und Festkoerperforschung 2 (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

A phenomenological cavitation model is presented by means of which the life time as well as the creep curve equations can be calculated for cavitating materials subjected to time variable tensile loads. The model precludes the proportionality between the damage A and the damage rate (dA/dt) resp. Both are connected by the life time function tau. The latter is derived from static stress

rupture tests and contains the loading conditions. From this model the life fraction rule (LFR) is derived. The model is used to calculate the creep curves of cavitating materials subjected at high temperatures to non-stationary tensile loading conditions. In the present paper the following loading procedures are considered: creep at constant load F and true stresses; creep at linear load increase ((dF/dt)=const) and creep at constant load amplitude cycling (CLAC). For these loading procedures the creep equations for cavitating and non-cavitating specimens are derived. Under comparable conditions the creep rate of cavitating materials are higher than for non-cavitating ones.

44628 (IWGFR—49-Vol.2, pp 817-828) **Effect of small amounts of helium on time dependent properties of DIN 1.4948.** Schaaf, B. van der (Netherlands Energy Research Foundation, Petten). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

In a liquid metal fast breeder reactor permanent near core structures such as instrumentation support, shields and reactor vessel are exposed to low total neutron fluences up to 10^{25} $n.m^{-2}$ at temperatures in the creep range. The neutron spectrum is thermalized by the coolant, sodium, to such an extent, that in the end of life condition the ^{10}boron isotope has substantially transmuted into helium and lithium. The amount of helium depends on the location of the component with respect to the neutron source: the core. For the design and safety analysis it is essential to determine the effect of helium on the time dependent properties. In the present investigation the amount of helium has been varied in the range from $2*10^{-3}$ appm to 20 appm for one heat of DIN 1.4948 by carrying out irradiations in the core of the HFR at 823 K and varying the irradiation time. The creep strength and rupture ductility decreases with increasing helium content. The grain size of the same heat has been varied from 100 μm to 230 μm. With increasing grain size the creep strength is decreasing in both unirradiated and irradiated condition. Several models to explain the observed behaviour are discussed. The implications of helium on coarse grained heat affected zones of welded structures are given.

44629 (IWGFR—49-Vol.2, pp 829) **Effect of boron on the development of helium induced creep embrittlement in type 316 stainless steel.** Marshall, P.; Rose, P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Schaaf, B. van der (Netherlands Energy Research Foundation, Petten). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

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44630 (IWGFR—49-Vol.2, pp 831-856) **Fracture mechanics behaviour of neutron irradiated Alloy A-286.** Mills, W.J.; James, L.A. (Westinghouse Hanford Co., Richland, WA (USA)). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The effect of fast-neutron irradiation on the fatigue-crack propagation and fracture toughness behaviour of Alloy A-286 was characterized using fracture mechanics techniques. The fracture toughness was found to decrease continuously with increasing irradiation damage at both 24 deg. C and 427 deg. C. In the unirradiated and low fluence conditions, specimens displayed appreciable plasticity prior to fracture, and equivalent Ksub(Ic) values were determined from Jsub(Ic) fracture toughness results. At high irradiation exposure levels, specimens exhibited a brittle Ksub(Ic) fracture mode. The 427 deg. C fracture toughness fell from 129 $MPa\sqrt{m}$ in the unirradiated condition to 35 $MPa\sqrt{m}$ at an exposure of 16.2 dpa (total fluence of $5.2 \times 10^{22} n/cm^2$). Room temperature fracture toughness values were consistently 40 to 60 percent higher than the 427 deg. C values. Electron fractography revealed that the reduction in fracture resistance was attributed to a fracture mechanism transition from ductile microvoid coalescence to channel fracture. Fatigue-crack propagation tests were conducted at 427 deg. C on specimens irradiated at 2.4 dpa and 16.2 dpa. Crack growth rates at the lower exposure level were comparable to those in unirradiated material, while those at the higher exposure were slightly higher than in unirradiated material.

44631 (IWGFR—49-Vol.2, pp 857-880) **Effects of low dose fast neutron irradiation on the fracture toughness of Type 316 stainless steel and weld metal.** Picker, C.; Stott, A.L.; Cocks, H. (UKAEA Risley Nuclear Power Development Labs.). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

This paper describes the results of fracture toughness tests on Type 316 steel and weld metal irradiated in the core of a thermal reactor to damage doses in the range 0.4 to 4 dpa (N/2). The results show that the superior toughness of Type 316 steel over the weld metal is retained for doses up to 4 dpa (N/2) and that no significant degradation in initiation fracture toughness occurs for damage doses up to 2 dpa (N/2). Appreciable degradation of initiation fracture toughness occurs for both materials at 4 dpa (N/2) but the most serious effect is the very low tearing resistance produced in Type 316 weld metal at this damage dose.

44632 (IWGFR—49-Vol.2, pp 881-914) **Elastic-plastic fracture toughness characteristics of irradiated AISI 316 H stainless steel.** Bernard, J.; Verzeletti, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531. (CONF-8310198—Vol.2).

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

The objective of this research is the FM assessment of neutron damage to AISI 316 H steel commonly used in LMFBR's permanent primary circuit components. The material FM characteristics studied are the crack-initiation toughness and the crack-resistance curves. The AISI 316 H stainless steel has been considered in the base condition, the welded deposit and the HAZ material. The specimens tested are 3PB bars. The results presented cover the 0, 0.1 dpa and 0.3 dpa fluences at 350 deg. C and 550 deg. C. The crack-growth-resistance curves were obtained following the dimensional analysis approach together with the deformation theory of plasticity concepts. This method, using key curves has effectively shown trends in the above-mentioned fracture mechanics characteristics of the irradiated AISI 316 H steel. The results obtained so far indicate generally low degradation at both temperatures between the non-irradiated and the irradiated base material, one note-worthy exception being the significant lowering at 550 deg. C and 0.1 dpa of sup(dJ)/da by about 35% and of sup(J)Ic by about 50% with respect to those parameters values in the other conditions of fluences and temperatures. As far as the weld material is concerned, it exhibits significantly lower initiation toughness and tearing moduli in the pre and post irradiation conditions with respect to the base material but those FM parameters values are practically unaltered at both temperatures and all fluence levels. The HAZ material was studied too and it was found that all J values corresponding to various crack advances fell within the base material results at 350 deg. C as upper bound and the welded material at 550 deg. C as lower bound at corresponding fluence levels.

44633 **(IWGFR—49-Vol.2) Specialist meeting on mechanical properties of structural materials including environmental effects, Chester, England, 10-14 October 1983.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors). 1983. 649p. (CONF-8310198—Vol.2). NTIS (US Sales Only), PC A99/MF A01. File Number DE85781531.

From IAEA specialists on mechanical properties of structural materials; Chester, UK (10 Oct 1983).

Individual papers in scope for the data base were abstracted and indexed separately.

44634 **(JAERI-M—83-241) Preparation of zirconium and zirconium-base alloy certified reference materials JAERI-Z11 to -Z18.** (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85701858.

The Second Sub-Committee on Zircaloy Analysis was organized in April, 1978, under the Committee on Analytical Chemistry on Nuclear Fuels and Reactor Materials, JAERI, for the renewal of zirconium and zirconium-base alloy certified reference materials (CRM's). The Sub-Committee decided certified values of major constituents and impurities in eight reference materials (JAERI - Z11 to -Z18) in July, 1983, based on the results obtained by cooperative analysis during 1978 to 1983. CRM's JAERI-Z11 to -Z14 are Zircaloy-2 in the form of disk, 32 mm in diameter and 20 mm in thickness, and useful primarily for fluorescent X-ray and emission spectrographic analysis. CRMs JAERI-Z15 and -Z16 are zirconium in the form of plate, 30 mm square and 2 mm in the thickness, and specially designed for the analysis of hafnium at trace levels : 2 to 40 μg/g. CRM's JAERI -Z17 and -Z18 are Zircaloy-2 and -4, respectively, in the form of chips, packed in a glass bottle of which content is 25 g and useful for the analysis of carbon in Zircaloy. This report describes mainly preparation of certified reference materials, and homogeneity test by neutron activation analysis and fluorescent X-ray spectrometry. CRMs JAERI-Z11 to -Z14 have been distributed with provisional certificate since July, 1979.

44635 **(KFK—3808) Surface properties of alkali metals studied by the density matrix method.** Bohnen, K.P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik; Regensburg Univ. (Germany, F.R.). Naturwissenschaftliche Fakultaet 2 - Physik). Aug 1984. 115p. (In German). Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.).

The electronic structure of surfaces of simple metals has been studied by a direct determination of the density matrix in a local orbital basis. The method is based on a variational treatment of the ground-state energy applying the Hohenberg-Kohn-Sham functional formalism. We present here results for low-index surfaces of a series of alkali metals for which the ionic pseudopotential is treated nonperturbatively. The results for surface charge density, work function and surface energy are compared with other self-consistent calculations and experimental values. Surface relaxation of the first interlayer spacing has also been studied self-consistently. For the (110)-surfaces of all alkali metals we find no or only very small relaxation. The (110)-surfaces show bigger relaxation effects and these vary from 3.5% inward for Li to 1% outward for Cs. These findings are consistent with general trends found in Leed- or ion scattering studies. Force constants for the movement of the last atomic layer are also determined.

44636 **(LA-UR—85-2481) Evaluation of anelastic evidence for interstitial solute binding in bcc metals.** Cost, J.R.; Stanley, J.T. (Los Alamos National Lab., NM (USA); Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). 1985. Contract W-7405-ENG-36. 4p. (CONF-8506125—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015705.

From Conference on internal friction and ultrasonic attenuation in solids; Urbana, IL, USA (3 Jun 1985).

A Direct Spectrum Analysis (DSA) technique has been applied to key internal friction and elastic after-effect data which are involved in the controversy over the existance of interstitial clustering in the refractory metals. It is found that at relatively high interstitial solute concentrations some of the Snoek peak broadening is due to relaxations that are distinct from the main relaxation. This finding supports the view that interstitial solutes have an interaction that produces clusters of interstitials.

44637 **(LA-UR—85-2515) Mach stem characterization in Mbar designs using RSR powder.** Staudhammer, K.P.; Johnson, K.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850736—59). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015700.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

Suitable selection of powders can be used as a modeling device for complicated experimental designs. The powder melt zone is clearly defined and the RSR-834 powder is reasonably well behaved. This experiment was with only one composition, size and distribution. However, it is believed that other morphologies, composition, and size distributions could result in a more complete modeling of the compaction process that would enable heuristic calculations of the combined effects of adiabatic temperature rise and entropic heating (strain/deformation).

44638 **(LBL—19235) Theoretical analysis of the aging response of Al-Li alloys strengthened by Al_3Li precipitates.** Glazer, J.; Edgecumbe, T.S.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 19p. (CONF-850777—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016570.

From 3. international aluminum-lithium conference; Oxfordshire, England (9 Jul 1985).

The possibility of increasing the strength of aluminum-lithium alloys hardened principally by the δ' precipitates was investigated. The elastic theory of phase transformations was used to determine that the δ' precipitate is not expected to deviate from spherical morphology even at very large sizes. The theory of the critical resolved shear stress for dislocation glide through a random array of obstacles was used to predict a moderate strengthening increment if the precipitate size distribution could be made more uniform. Experimental and theoretical hardening curves for an experimentally determined precipitate size distribution were also compared.

44639 **(NUREG/CR—3900-Vol.4) Long-term performance of materials used for high-level waste packaging. Annual report, year three, April 1984-April 1985. Volume 4.** Stahl, D.; Miller, N.E. (comps.). (Battelle Columbus Labs., OH (USA)). Jul 1985. 233p. (BMI—2127-Vol.4). NTIS, PC A11/MF A01 - GPO. File Number TI85902045.

As part of the Nuclear Regulatory Commission's requirement to assess the Department of Energy's application to construct geologic repositories for high-level radioactive waste, Battelle's Columbus Laboratories is investigating the long-term performance of materials used for high-level waste packages. Waste form experimentation has focused on borosilicate glass, using the reference composition MCC 76-68. An experiment investigated the influence of continuous contact between the glass specimen and the leachate on the results of corrosion studies. It was found that precipitates formed during cooling can affect the results. Other experiments evaluated the influence of crystallization on glass waste-form performance and the influence of organic acid on the waste-form and radionuclide mobility in groundwater. Models were used to analyze glass dissolution, including the reprecipitation of dissolved glass species. The effect of groundwater species on the electrochemistry of steels is being analyzed to evaluate susceptibility to pitting and stress-corrosion cracking. Species identified as potential cracking agents are being investigated by slow strain rate experiments. Hydrogen embrittlement studies of steel showed annealed cast steel to be more sensitive to embrittlement. Realistic general and pitting corrosion models are being developed, based on known principles of mass transport and radiolytic production. Mechanical and water-chemistry-related stresses which influence mechanical degradation were evaluated. Groundwater-radiolysis and water-chemistry studies are continuing as part of the integrated system performance task. 78 refs., 83 figs., 41 tabs.

44640 **(PNL-SA—13122) Oxidation of Zircaloy-4 in steam at 1300 to 2400°C.** Prater, J.T.; Courtright, E.L. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 26p. (CONF-850601—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85016281.

From 7. international conference on zirconium in the nuclear industry; Stasbourg, France (24 Jun 1985).

The oxidation kinetics of Zircaloy-4 in steam have been extended to 2400°C. Growth of the ZrO_2 and α-Zr layers display parabolic behavior over the entire temperature range studied; however, a discontinuity in the oxidation kinetics above 1510°C causes rates to increase above those previously established by the Baker-

Just relationship. This increase coincides with the tetragonal-to-cubic phase transformation in ZrO/sub 2-x/. No additional discontinuity in the oxide growth rate is observed upon melting of Zr(O). The effects of temperature gradients have also been taken into account and corrected values representative of near-isothermal conditions have been computed. Experiments have been performed in steam-hydrogen mixtures at 1565 and 1815°C. Concentrations of hydrogen up to 90 mole % have no effect on the oxidation kinetics. The rate controlling factor appears to be the available flux of oxygen atoms incident to the reaction surface, and is not dependent upon hydrogen content.

44641 (SAND—85-0483C) Shock synthesis of nickel aluminides. Simonsen, I.K.; Horie, Y.; Graham, R.A. (North Carolina State Univ., Raleigh (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-850736—42). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015164.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

Localized formation of solid solutions and NiAl were observed in a specimen subjected to the weakest loading conditions (peak pressure of 5.0 GPa and peak temperature of 250°C). This is an indication of greatly enhanced solid state reactivity encountered under shock wave loading. The formation of bulk Ni_3Al appears to require a temperature of about 400°C, but the reactions are inhibited by high pressures (above 15 GPa).

44642 (SAND—85-1020C) Oxide formation on Rh field emitter surfaces and its reduction by CO. Kellogg, G.L. (Sandia National Labs., Albuquerque, NM (USA)). [1985]. Contract AC04-76DP00789. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016817.

The growth of oxide films on Rh surfaces and their reduction by CO has been systematically studied by imaging atom-probe mass spectroscopy and field ion microscopy. The tips were oxidized and reduced in a "high-pressure" reaction chamber at pressures of 1 Torr and subsequently transferred under ultrahigh vacuum to an imaging atom-probe for analysis. The total uptake of oxygen and the chemical form of the oxide were measured as a function of time and temperature. The time dependence suggested that oxide formation on Rh follows a logarithmic growth law and the temperature dependence yielded an activation energy of 3.1 kcal/mole. Field ion microscopy of oxidized tips indicated that the oxide layers were non-uniform. Rhodium oxides were reduced in 1 Torr CO at temperatures slightly above 400 K.

44643 (UCID—20436) Metallurgical analysis of a 304L stainless steel canister from the Spent Fuel Test - Climax. Weiss, H.; Van Konynenburg, R.A.; McCright, R.D. (Lawrence Livermore National Lab., CA (USA)). 23 Apr 1985. Contract W-7405-ENG-48. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017148.

Results of a metallurgical examination of a type 304L stainless steel canister that had been used to store spent nuclear fuel in an underground granite formation for about three years are reported. No observable corrosion or cracking were found. The results are applied to waste packages in a potential high level nuclear waste repository in tuff. 10 refs., 9 figs., 2 tabs.

44644 (UCID—20499) Spent fuel cladding corrosion under tuff repository conditions: initial observations. Smith, H.D.; Oversby, V.M. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013241.

The Westinghouse Hanford Company program is investigating corrosion and stress corrosion cracking of Zircaloy-2 and 4 in two model tuff repository environments using an experimental approach in which the repository environment is reproduced as accurately as possible, including temperature, radiation field, water chemistry and materials associations. Post-experimental sample evaluation utilizes or will utilize sophisticated SEM/STEM, Auger surface analysis/ion milling, and trace element release to detect, locate and measure the effects of corrosion. The experiments themselves are being conducted using actual spent fuel and repository materials at repository conditions. The short experimental time (i.e., one year) is being compensated for by sensitive measuring techniques. Characterization of any corrosion found will be used to understand the mechanisms involved for extrapolation purposes. The initial evaluation of samples from two, six, and 12-month electrochemical corrosion experiments indicated no Zircaloy-4 corrosion at a detection sensitivity of 1 to 2 μm of corrosion per year. To improve the sensitivity of the experiment, baseline conditions (e.g., beginning with a polished metal surface) will need to be established that are expected to make it possible to resolve corrosion on the scale of hundreds of angstroms. Examples are the development of such measurements as film depth determination via Auger surface analysis/ion milling and Zr and ^{14}C released into the aqueous corrosion environment. Characterization of any corrosion found will be used to understand the mechanisms involved. This will allow extrapolation of results to predict cladding lifetime under repository conditions. 3 refs.

44645 (UCRL—15661-Vol.2) Processing and problems in manufacturing a Ti-modified Nb_3Sn MJR billet. Volume 2. McDonald, W.K.; Smathers, D.; Geno, J.D.; O'Larey, P.M. (Teledyne-Wah Chang, Albany, OR (USA)). 18 Jun 1985. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017281.

This report is submitted to complete Task II of University of California Order Number 4321405. Task I had Teledyne Wah Chang Albany (TWCA) assemble and process by the Modified Jelly Roll (MJR) method a Ti-modified Nb_3Sn superconductor billet. This billet was identified as M103 by TWCA. The billet matrix is nominally composed of copper 13.5 wt % tin bronze sheet and niobium 1.2 wt % titanium expanded metal with a volume ratio of three parts bronze to one part niobium alloy. All processing steps and problems encountered in manufacturing billet M103 are described in this report.

44646 (UCRL—91561-Rev.1) Deposition of selenium coatings on beryllium foils. Revision 1. Erikson, E.D.; Tassano, P.L.; Reiss, R.H.; Griggs, G.E. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. 14p. (CONF-8409150—5-Rev.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016070.

From 12. world conference of the International Nuclear Target Development Society; Antwerp, Belgium (25 Sep 1984).

A technique for preparing selenium films on 50.8 micrometers thick beryllium foils is described. The selenium was deposited in vacuum from a resistance heated evaporation source. A water-cooled enclosure was used to minimize contamination of the vacuum system and to reduce the exposure of personnel to toxic and obnoxious materials. Profilometry measurements of the coatings indicated selenium thicknesses of 5.5, 12.9, 37.5, 49.8 and 74.5 micrometers. The control of deposition rate and of coating thickness was facilitated using a commercially available closed-loop programmable deposition controller. The x-ray transmission of the coated substrates was measured using a tritiated zirconium source. The transmissivities of the film/substrate combination are presented for the range of energies from 4 to 20 keV.

44647 (UCRL—92345) Investigation of the cryogenic mechanical properties of low thermal-expansion superalloys. Summers, L.T.; Dalder, E.N.C. (Lawrence Livermore National Lab., CA (USA)). 30 Jul 1985. Contract W-7405-ENG-48. 9p. (CONF-850814—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016650.

From Cryogenic engineering conference and international cryogenic materials conference; Boston, MA, USA (12 Aug 1985).

Four Fe-based superalloys, JBK-75, Incoloy 903, Incoloy 905, and Incoloy 909 were evaluated as tube materials for ICCS Nb_3Sn superconductors. Evaluation consisted of 4-K tensile and elastic-plastic fracture-toughness testing, and a microstructural characterization of unwelded and autogenously gas-tungsten-arc welded sheet given a simulated postweld processing treatment of 15% cold reduction by rolling followed by a Nb_3Sn-reaction heat treatment of 96 hours at 700°C plus 48 hours at 730°C. Results indicate that JBK-75 and Incoloy 903 showed satisfactory combinations of strength and toughness for ICCS tube use requiring long Nb_3Sn-re-

action heat treatments. Incoloy 905 welds and 909 showed unacceptable fracture toughness. Results are discussed in terms of microstructural changes caused by the extended Nb_3Sn-reaction heat treatment.

44648 (UCRL—92776) Computer simulation and analysis of the expanding ring test. Reaugh, J.E. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 12p. (CONF-850736—58). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016943.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

Explosive launched expanding ring tests have been used to extract material flow stress at strain-rates from 10^3 to 3×10^4 sec^{-1}. Computer simulations of such tests using a strain-rate independent, but work hardening constitutive model were analyzed by the same methods used experimentally. Results of this analysis also showed an apparent strain-rate effect. Further examination of the computer simulations has shown that much, if not all, of the measured strain-rate effect is an increased flow stress due to a plastic strain, ϵ/sub L/, that is locked in during the initial stages of launch. At a larger launch velocity, hence a larger strain-rate, ϵ/sub L/, is also larger. The value of ϵ/sub L/ is sensitive to details of the launch dynamics. 8 refs., 5 figs.

44649 (UCRL—92899) High-pressure ion-thermal properties of metals from ab initio interatomic potentials. Moriarty, J.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 10p. (CONF-850736—55). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016079.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

It has recently become possible for the first time to calculate ab initio two-ion and three-ion interatomic potentials in d-electron transition metals. The nature of these potentials for the 3d series metals is discussed. In the case of copper, where three-ion contributions may be neglected, application is made to the ion-thermal component of the equation of state and to the calculation of melting on the shock Hugoniot. 13 refs., 3 figs.

44650 (Y—2346) X-ray diffraction study of reversible deformation mechanisms in the aged uranium-6.5 niobium alloy. Carpenter, D.A. (Oak Ridge Y-12 Plant, TN (USA)). 21 Jun 1985. Contract AC05-84OS21400. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015049.

The x-ray diffraction (XRD) data from 200°C/2h-aged uranium-6.5 wt % niobium (U-6.5Nb) alloys, taken under stress as a function of strain, revealed a gamma-zero (γ^0)→ alpha prime-prime (α'') thermoelastic martensitic phase transformation. It was concluded that the primary reversible deformation modes consisted of the movement of γ^0/α'' interphase interfaces and α'' intervariant interfaces. Specimen elasticity at low strains was associated with the retreat of interphase interfaces. At higher strains, interphase interfaces did not recover significantly on unloading, and elasticity was due primarily to the retreat of α'' intervariant interfaces.

44651 Dependence of 1/f noise on defects induced in copper films by electron irradiation. Pelz, J.; Clarke, J. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **55**: No. 7, 738-741(12 Aug 1985). Contract AC03-76SF00098.

When 500-keV electron irradiation was used to induce defects in polycrystalline copper films maintained at 90 K, the spectral density of the 1/f noise voltage across the films increased by as much as 1 order of magnitude, while the resistivity increased by at most 10%. When the films were annealed at progressively higher temperatures, both the 1/f noise and the resistivity were reduced; however, at lower annealing temperatures, the fractional reduction in the added noise was substantially more than that in the added resistivity.

44652 Ion beam studies of hydrogen in metals. Myers, S.M.; Wampler, W.R. (Sandia National Labs., Albuquerque, NM (USA)); Besenbacher, F. (Aarhus Univ. (Denmark). Inst. of Physics); Robinson, S.L.; Moody, N.R. (Sandia National Labs., Livermore, CA (USA)). *Materials Science and Engineering;* **69**: No. 2, 397-409(Mar 1985). (CONF-8409130—).

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Methods based on ion implantation and nuclear reaction analysis have been developed and used to investigate fundamental aspects of the behavior of hydrogen isotopes in metals. The binding enthalpy of deuterium at irradiation defects, helium bubbles, deuterium bubbles and metal-oxide interfaces was measured for aluminum, iron, nickel, copper, palladium, austenitic stainless steel, Inconel and amorphous $Fe_{40}Ni_{40}P_{14}B_6$. The binding enthalpies determined for the pure metals are in excellent agreement with mechanistic calculations based on effective medium theory and other information. Surface-limited release of deuterium from iron, stainless steel and Inconel was measured as a function of temperature and the state of surface oxidation. The release rate was accurately proportional to the square of the deuterium concentration in solution, permitting the results to be expressed in terms of a surface recombination coefficient. This quantity was up to four orders of magnitude greater for an ion-sputtered surface than for a surface with electropolish oxide. The diffusion coefficient and solid solubility of tritium in stainless steel were measured for the first time at the ice point, thereby extending downward by three orders of magnitude the diffusivities available from conventional permeation experiments. Deuterium concentration profiles resulting from electrochemical charging of Incoloy 903 were measured as a function of charging current, thereby providing a direct systematic calibration of such charging in an austenitic material where conventional permeation measurements are precluded by the small hydrogen diffusion rate.

44653 Fundamental aspects of ion beam surface modification: defect production and migration processes. Rehn, L.E.; Averback, R.S.; Okamoto, P.R. (Argonne National Lab., IL (USA)). *Materials Science and Engineering;* **69**: No. 1, 1-11(Feb 1985). (CONF-8409130—).

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Ion beam modification of metals is generating increasing scientific interest not only because it has exciting technological potential but also because it has raised fundamental questions concerning radiation-induced diffusion processes. In addition to the implanted species, several defect production and migration mechanisms contribute to changes in the near-surface composition of an alloy during ion bombardment, e.g. atoms exchange positions via displacements and replacement sequences, preferential sputtering effects arise, and radiation-enhanced diffusion and radiation-induced segregation occur. The last two defect migration mechanisms are of particular significance since they can alter the composition to depths which are much greater than the implanted ion range. By altering various parameters such as irradiation temperature, ion mass, energy and current density and by changing the initial alloying distributions, a rich variety of near-surface composition profiles can be created. The authors have utilized changes in ion mass and energy and irradiation temperature to distinguish defect production from defect migration effects. Experimental results are presented which provide a guide to the relative efficiencies of different mechanisms under various irradiation conditions.

44654 Effect of boron on grain-broundaries in Ni3Al. Liu, C.T.; White, C.L.; Horton, J.A. (Oak Ridge National Lab., TN). *Acta Metallurgica;* **33**: 213-229(Feb 1985). Contract AC05-84OR21400.

The effects of boron concentration, alloy stoichiometry, and microstructure on the strength and ductility of Ni3Al containing 24 and 26 at. pct Al are investigated. The ductility and fracture behavior of B-doped Ni3Al, which depend on deviation from alloy stoichiometry, are characterized by tensile tests at room temperature, and are correlated with grain boundary chemistry and structure features as determined by Auger electron spectroscopy, SEM, and TEM. With a decrease in aluminum content of B-doped Ni3Al below 25 at. pct, the ductility increases dramatically and there is a

change in fracture mode from intergranular to transgranular. It is shown that the level of boron segregated to grain boundaries increases and that the amount of grain-boundary aluminum decreases with decreasing bulk aluminum concentration. Boron also has a tendency to segregate to the grain boundaries but not to cavity surfaces, whereas sulfur demonstrates the opposite behavior. The results are in agreement with existing theories of solute segregation effects on grain-boundary cohesion. It is also shown that annealing treatment at 1000°C results in an increase in grain size and a decrease in yield strength. 58 references.

44655 Quantitative interpretation of surface segregation in air-exposed intermetallic compounds: UNiAl as a test case. Jacob, I. (Brookhaven National Lab., Upton, NY (USA)); Fisher, M.; Hadari, Z. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Nuclear Engineering). *Journal of the Less-Common Metals;* **103**: No. 2, 415(15 Nov 1984). (CONF-8404106—).

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

Published in summary form only.

44656 Comments on "Methods for the determination of the activation energy of glass crystallization from thermal analysis". Bansal, N.P.; Bruce, A.J.; Doremus, R.H.; Moynihan, C.T. (Rensselaer Polytechnic Institute, Troy, NY). *Physics and Chemistry of Glasses;* **25**: No. 3, 86-88(Jun 1984). Contract AC02-76ER01198.

In a previous paper Speyer and Risbud reported the kinetic parameters for the crystallization of amorphous $CdGeAs_2$ using differential scanning calorimetry. Several aspects of the experimental techniques and data analysis make their results and conclusions doubtful. These results and conclusions are discussed. Speyer and Risbud reply and discuss the conclusions of Bansal et al. They are in categoric disagreement with the conclusions of Bansal et al. The reasons for their disagreement are presented.

44657 1982 national powder metallurgy conference proceedings. Bewley, J.G.; McGee, S.W. (eds.). Princeton, NJ; Metal Powder Industries Federation (1983). 634p. (CONF-8205171—). Metal Powder Industries Federation, 105 College Road East, Princeton, NJ 08540.

From National powder metallurgy conference; Montreal, Canada (24 May 1982).

Forty-five papers were presented at the conference. A separate abstract was prepared for each of 10 papers for the Energy Data Base (EDB). The remaining papers were not in scope for EDB.

44658 Effect of spin-glass ordering on the specific heat of CuMn. Brodale, G.E.; Fisher, R.A.; Fogle, W.E.; Phillips, N.E.; Van Curen, J. (Lawrence Berkeley Lab., CA). *Journal of Magnetism and Magnetic Materials;* **31-34**: 1331-1333(1983). Contract AC03-76SF00098.

High-precision measurements have shown the nature of the specific heat anomaly associated with the transition to the spin-glass phase in CuMn, and have been used to determine the entropy as a function of the field and temperature. 7 references, 6 figures.

44659 (BG-Trans—07132) Commercial application of heat resistant materials in petrochemical processing furnaces. Herda, W.R.; Maylor, J.B. Translated from *Werkstoffe und Korrosion ;* **28**: No. 2, 73-78(1977). 12p. NTIS, PC A02/MF A01. File Number DE85902074.

The authors have endeavoured to provide an overall picture of the present state of development of nickel alloy wrought materials, especially for applications in chemical process furnaces, and suggested that there are potentials here for commercial applications for EDC furnaces, ethylene furnaces and reforming furnaces. The advantages demonstrated allow expectations that in the future extruded tubes will be considered by furnace designers as a reasonable alternative to centrifugally cast furnace tubes. Beside metallurgical considerations the decisive factors are above all the typical advantages of the extruded tube, the availability of large quantities from a single batch, the wide dimensional variations possible and the making available of great tube lengths.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 43631, 43812, 43867, 43867, 43867, 44090, 44409, 44409, 44409, 44436, 44633, 45392, 45392, 45834, 45835, 45836

44660 (CEA-CONF—7364) Radiation damage in boron carbide: swelling and microcracking. Zuppiroli, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jun 1984. 6p. (In French). (CONF-8406260—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751187.

From 27. colloquium on metallurgy; Saclay, France (18 Jun 1984).

The present short review is an attempt to understand from a microscopic point of view the swelling and microcracking of boron carbide under neutron irradiation. The role of the different irradiation parameters is examined shortly according to the results available in the recent litterature and the role of radiation induced point defects on the nucleation and growth of the lenticular bubbles responsible of the damage is studied according to the results in our own group.

44661 (CEA-CONF—7486) Order and disorder in transition metal carbides and nitrides: experimental and theoretical aspects. de Novion, C.H.; Landesman, J.P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1984. 4p. (CONF-8404234—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752053.

From 8. international conference on solid compounds of the transition elements; Vienna, Austria (9 Apr 1984).

Many carbides and nitrides of transition metals can be described as a close-packed metal lattice (f.c.c. or h.c.) with the carbon or nitrogen atom in the center of the octahedral interstices. If these octahedal sites are not all occupied, the unoccupied sites may be considered as "vacancies" in the metalloid sublattice. Depending on the composition and the thermal treatment, these "vacancies" may be found ordered (forming a sublattice) or disordered. "Vacancies" and metalloid atoms form a pseudo "solid-solution", with order-disorder phenomena analogous to those encountered in metallic solid solutions Asub(1-x)Bsub(x). Recent results are reviewed: order-disorder transitions are studied by neutron diffraction at high temperature and short-range order by diffuse neutron scattering. A theoretical interpretation of results is briefly presented.

44662 (CEA-CONF—7689) Gas adsorption during storage of plutonium dioxide powders. Cuillerdier, C.; Cossonnet, C.; Germain, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Oct 1984. 10p. (CONF-841014—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752062.

From International conference on nuclear and radiochemistry; Lindau, Bodensee, F.R. Germany (8 Oct 1984).

Adsorption phenomena occuring in plutonium dioxide containers are studied for the determination of safe conditions for storage and transportation of plutonium dioxide powders. Adsorption on dried PuO_2 of air individual gases, influence of powder isotopic composition, chemisorption, effect of moisture are determined. Adsorption of dry air obeys an Elovich's law for its kinetics it is greatly exchange by α radiolysis. Pressure in the container can be reduced by storage under dry inert gas (Ar), decreasing the PuO_2 load and using powder containing preadsorbed water or wet air then radiolysis may occur (H_2 formation).

44663 (CONF-850781—2) Annealing studies of alpha-Al_2O_3 implanted with bromine. Farlow, G.C.; McHargue, C.J.; White, C.W.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015415.

From International conference on radiation effects in insulators; Guildford, Surrey, UK (15 Jul 1985).

Aluminum oxide was implanted with bromine and subsequently annealed at temperatures between 800 and 1500°C in a reducing atmosphere. Changes in the lattice damage and the impurity distribution were monitored at Rutherford backscattering and chan-

neling (RBS-C) techniques. Changes in the topography were monitored by optical and secondary electron microscopy. The implantation resulted in the formation of an "amorphous" surface layer. Upon annealing, the bromine segregated to form bubbles which blistered releasing 90% of the bromine from the Al_2O_3 matrix.

44664 (CONF-850840—10) Analytical electron microscopy of surface modified ceramics. Sklad, P.S. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016309.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

While the effects of implantation on surface sensitive properties may be measured independently, it is important to understand the microstructural evolution leading to these changes. Analytical electron microscopy provides a useful tool for characterizing the microstructures produced in terms of solute concentration profiles, second phase formation, lattice damage, crystallinity of the implanted layer, and annealing behavior. Such analyses allow correlations to be made with theoretical models, property measurements, and results of complimentary techniques.

44665 (CONF-850952—1) Wear of ion implanted TiB/ sub 2/ surfaces. Yust, C.S.; McHargue, C.J.; White, C.L.; Angelini, P.; Lewis, M.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017091.

From Symposium on tribology; Lyon, France (3 Sep 1985).

The properties of polycrystalline titanium diboride surfaces were significanly modified by ion implantation. Nickel ion implantation at room temperature (1 x 10^{17} ions/cm^2, 1 MeV) produced a damage, crystalline surface in which dislocation tangles and defects were observed to a depth of 750 nm. Surface hardness values as measured by the Knoop method were 1.7 to 2.2 times those of unimplanted material, and the indentation fracture toughness was increased 50 to 90%. Wear resistance was evaluated by pin-on-disc tests in which a diamond stylus rubs against a polished surface containing both implanted and unimplanted regions. Auger electron spectroscopy was used to identify the constituents of an adhered debris layer on the resultant wear tracks. The debris layer was found to contain some oxygen, but was composed primarily of carbon.

44666 (DOE/ER/01198—2055) Grain boundary structure in alumina. Shiue, Y.R. (Illinois Univ., Urbana (USA)). 1985. Contract AC02-76ER01198. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016726.

In liquid phase sintered aluminas, basal twins and glass phase at boundary regions are very common. The microstructures of a very glassy alumina show that coarse ledges (up to several hundred angstroms in height) are usually present at the Al_2O_3/glass interface and the preferred ledge plane is (0001). This result suggests that the basal plane is the most stable plane at Al_2O_3/glass interfaces while [(1 bar)012] plane is the most stable surface in Al_2O_3. The hot-pressed high purity material contains a small number of basal twins, rhombohedral twins, [(1 bar)011] twins and [10(1 bar)1] twins. This material also shows no detectable glass film at boundary regions. Both basal and rhombohedral twins have been shown to occur in alumina ceramics while the [(1 bar)011] and [10(1 bar)1] twins have never been reported in Al_2O_3. The four are well described by the conventional CSL/DSCL models as Σ = 3, 7, 11 and 11 boundaries, respectively. Basal twins sometimes, and rhombohedral twins always, contain SGBDs whose Burgers vectors lie on the relevant DSCL. The [(1 bar)011] and [10(1 bar)1] twins show stacking-fault like fringes at the [1(2 bar)10] common reflections. It is concluded that these boundaries contain rigid body displacement vectors to relieve atomic overcrowding at boundary regions. The magnitudes of displacement vectors at the [(1 bar)011] twin boundary can be measured indirectly by comparing the experimental image contrast with image simulation in computer.

44667 (INIS-mf—9320) Influence of high energetic irradiations with heavy ions on the magnetic properties of ferrimagnetic iron granates. Heitmann, H. (Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 12 Dec 1983. 193p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85781554.

With the aim of magnetic, magnetooptical and optical measurement techniques ion tracks produced by energetic heavy ion irradiations in ferrimagnetic granates have been investigated. In detail, the irradiations done in the temperature range 4.2 K <= T <= 550 K affect the saturation magnetization, the uniaxial anisotropy field, the Faraday rotation, the optical absorption and the value of the Curie-temperature. An interpretation of the observed radiation effects has been tried on the basis of the induced defect structures in the granates.

44668 (IPNO-DRE—84-02) Solid state physics and actinide spectroscopy with $ThBr_4$ and $ThCl_4$. Genet, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 85p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752052.

From the solid state physics to the optical spectroscopy of 5 f elements, we have described in details how $ThBr_4$ and $ThCl_4$ are acting an important role in the applied and basic research field. The possible applications are based on the scintillation properties of these crystals while the fundamental aspect is related to their special incommensurate structure which modulates the host properties of these matrices at low temperature. This very small perturbation of bromine atom positions have optical consequences on the absorption and emission of the actinide studied ions which are interpreted in function of the modulated structure parameters determined by inelastic and elastic neutron scattering and by Raman spectroscopy. The structural model proposed shows, for the first time, how the optical properties of the investigated ion are influenced by the sinusoidal displacements of the bromine atoms, leading to an energy continuum in the absorption and reducing the site symmetry from Dsub(2d) to a multisite of D_2 symmetry.

44669 (MLM—3281(OP)) Metallography of titanium boride. Gustin, C.S.; Kelly, M.D. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 13p. (CONF-850753—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016450.

From International Metallographic Society conference; Denver, CO, USA (21 Jul 1985).

Combustion synthesis is a self-propagating, high temperature thermal reaction which forms compounds from the component powders. Titanium and boron powders are reacted to form titanium boride compounds by this process. The extreme hardness of titanium boride and the need to resolve the microstructure for image analysis required special metallographic techniques. These special techniques and some of the resulting microstructural analysis are discussed.

44670 (RISO-M—2495) Stability in air and reducing atmospheres of ceria-gadolinia solid solutions prepared by coprecipitation. El Houte, S.; Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Mar 1985. 16p. Risoe National Lab., Roskilde (Denmark).

For the application of doped ceria as solid electrolytes for oxygen monitors and fuel cells it is important that these are both chemically and structurally stable at high temperatures in air and in strongly reducing atmospheres. In this work the structural stability of gadolinia doped ceria powders prepared by coprecipitation followed by calcination (air, 750degC) were examined by X-ray diffraction on samples heat treated in air in the temperature range 1000-1500degC. The compositions examined were 5, 8.4, 20.8, 25, 42.6, 50, 75, 90, 95, and 98 w/o Gd_2O_3. Except for the last two compositions no structural changes were observed even after the heat treatment at 1500degC indicating that solid solution powders prepared by coprecipitation are generally very stable in air. Finally, the X-ray diffraction patterns of the heat-treated powders also revealed that the structure of CeO_2-Gd_2O_3 solid solutions changes with increasing Gd_2O_3-content as follows: 0-40 w/o, fcc single phase; 40-50 w/o fcc and bcc two phase region; 75 w/o bcc single

phase; 95-98 w/o bcc single phase at 1300degC but bcc + monocliniic two-phase region at 1500degC.

44671 **(SAND—85-1661C) Effect of shock pressure and temperature on the deformation microstructure of rutile.** Carr, M.J.; Graham, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 21p. (CONF-850770—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016577.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

Annealed high purity rutile powders were shock loaded to peak pressures between 5 and 22 GPa and peak temperatures between 80 and 500°C, and then examined by transmission electron microscopy. Unusually large concentrations of dislocations were observed even at the lowest pressure. They increased in density rapidly with peak pressure, exceeding 10^{11}cm.$^{-2}$ above 8 GPa. Twinning was present at all pressures, but was more difficult to discern amid the dense substructure at higher pressures. Cleavage was common at 5 to 8 GPa, but rare at higher pressures. Recrystallized grains were observed at 16 GPa and 500°C. The occurrence of slip or twinning was affected by crystal orientation. Particle size and grain size were not significantly altered by shock compression. Slip on [100] planes was observed for the first time for this material. Crystallographic shear defects were not observed. 18 refs., 9 figs., 1 tab.

44672 **Model for low-temperature luminescence in lithium- and sodium-doped beryllium oxide single crystals.** Cooke, D.W.; Jahan, M.S.; Alexander C. Jr.; Shul'gin, B.V. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **58**: No. 6, 2302-2307(15 Sep 1985).

BeO:Li and BeO:Na single crystals have been investigated by thermoluminescence (TL) techniques in the interval 10—300 K. X-irradiated BeO:Na exhibits an intense glow peak at 85 K and a weak one near 46 K. BeO:Li displays intense glow at 72 K. Analyses of the two strong peaks (the weak one was not amenable to analysis) yield the following TL parameters: T/sub m/ = 72 K, E = 0.143 eV, s = 1.08 x 10^8 sec^{-1}, and l = 1.3; T/sub m/ = 85 K, E = 0.197 eV, s = 1.05 x 10^{10} sec^{-1}, and l = 1.2, where E is the thermal activation energy, s is the frequency factor, and l is the order of kinetics. Spectral emission from the two intense glow peaks were similar, characterized by band emission with maxima near 320 and 525 nm. A model consistent with previous TL and magnetic resonance results which adequately describes our data is presented. It is suggested that the main glow peaks are due to holes released at V centers whereby they recombine with F and F^+ centers. Recombination at the F center yields 525-nm radiation whereas recombination at the F^+ defect produces 320-nm emission. Optical excitation, photobleaching, and phototransfer experiments support this model.

44673 **Anomalous behavior of the Moessbauer resonance width in mixed-valence $EuNi_2P_2$.** Nagarajan, R.; Shenoy, G.K.; Gupta, L.C.; Sampathkumaran, E.V. (Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Bombay 400005, Maharashtra, India). *Physical Review [Section] B: Condensed Matter;* **32**: No. 5, 2846-2850(1 Sep 1985).

We present here the results of our detailed Moessbauer measurements on the mixed-valence system $EuNi_2P_2$. The linewidth of the resonance exhibits a broad peak at ~40 K. We argue that this feature is anomalous in that it cannot be understood in terms of the known mechanisms that can give rise to line broadening. The system exhibits strong mixed valence: the average valence being ~2.5: even at T = 1.4 K. This is the first Eu-based material having truly mixed valence behavior as T→0; all others tend to approach the trivalent configuration as T→0.

44674 **Large-area lanthanum hexaboride electron emitter.** Goebel, D.M.; Hirooka, Y.; Sketchley, T.A. (University of California, Los Angeles, School of Engineering and Applied Science, Los Angeles, California 90024). *Review of Scientific Instruments;* **56**: No. 9, 1717-1722(Sep 1985). Contract AT03-84ER52104.

A large-area cathode assembly which is capable of continuous, high-current electron emission is described. The cathode utilizes an indirectly heated lanthanum hexaboride (LaB_6) disk as the thermionic electron emitter. The LaB_6 cathode emits over 600 A of electrons at an average of 20 A/cm^2 continuously with no observable lifetime limits to date after about 400 h of operation in a plasma discharge. Proper clasping of the LaB_6 disk is required to avoid impurity production from chemical reactions with the holder and to provide adequate support if the disk fractures during rapid thermal cycling. Modification of the LaB_6 surface composition due to preferential sputtering of boron by hydrogen and argon ions in the plasma discharge has been observed. The surface appearance is consistent with the formation of LaB_4 as a result of boron depletion. The electron emission capability of the cathode is not significantly altered by the surface change. This surface modification by preferential sputtering is not observed in hollow cathodes where the ion energy from the cathode sheath voltage is typically less than 50 V. The electron emission by the cathode has not been affected by exposure to both air and water during operation. Utilizing thick disks of this intermediate temperature cathode material results in reliable, high-current, long-lifetime electron emitter assemblies.

44675 **Reactivity of ion-implanted SiC.** McHargue, C.J.; Lewis, M.B.; Williams, J.M.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). *Materials Science and Engineering;* **69**: No. 2, 391-395(Mar 1985). (CONF-8409130—).

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Implantation of chromium into single crystal or polycrystalline α-SiC produces a surface amorphous layer for displacement damage greater than about 0.2 displacements per atom at room temperature. The enhanced chemical reactivity of such specimens was studied by two methods: chemical etching rate and oxidation rate. The chemical etching rates in a saturated solution of 50% $K_3Fe(CN)_6$ plus 50% KOH were measured. The etching rate for the amorphous layer was 2.4-3.7 times that of the polycrystalline samples and 3.0-4.1 times that of the single-crystal samples. Polycrystalline specimens were exposed to flowing oxygen for 1 h at 1300°C. Rutherford backscattering and the nuclear reaction $^{16}O(d,p)^{17}O^*$ were used to determine the amount of oxygen on the surface. The amount of oxygen (and the thickness of oxide) over the amorphous region was 1.67 times that over the crystalline region. The relative thicknesses of the oxide on the amorphous and crystalline regions were confirmed by measuring the sputtering time required to remove the oxygen signal in an Auger spectrometer.

44676 **Resistance of titanium diboride to high-temperature plastic yielding.** Ramberg, J.R.; Wolfe, C.F.; Williams, W.S. (Illinois Univ., Urbana). *Journal of the American Ceramic Society;* **68**: C.78-C.79(Mar 1985).

Polycrystalline TiB2 specimens of 3 microns average grain size but free of lamellar precipitates were compression-tested to 1900°C and 500 MPa. No plastic yielding was detected. Under such conditions, most other structural ceramics do exhibit yield behavior. The results suggest the existence of a high Peierls stress, presumably related to Ti-B bonding. This finding contrasts with a report on ZrB2 in which resistance to yielding was attributed to lamellar precipitates. 13 references.

44677 **Amorphization of ceramics by ion beams.** McHargue, C.J.; Farlow, G.C.; White, C.W.; Williams, J.M.; Appleton, B.R.; Naramoto, H. (Oak Ridge National Lab., TN (USA)). *Materials Science and Engineering;* **69**: No. 1, 123-127(Feb 1985). (CONF-8409130—).

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

The influence of the implantation parameters fluence, substrate temperature and chemical species on the formation of amorphous phases in Al_2O_3 and α-SiC was studied. At 300 K, fluences in excess of 10^{17} ions cm^{-2} were generally required to amorphize Al_2O_3; however, the implantation of zirconium formed the amorphous phase at a fluence of 4 x 10^{16} Zr^+ ions cm^{-2}. At 77 K the threshold fluence was lowered to about 2 x 10^{15} Cr^+ ions cm^{-2}. Single crystals of α-SiC were amorphized at 300 K by a fluence of 2 x 10^{14} Cr^+ ions cm^{-2} or 1 x 10^{15} N^+ ions cm^{-2}. Implantation at

1023 K did not produce the amorphous phase in SiC. The microindentation hardness of the amorphous material was about 60% of that of the crystalline counterpart.

44678 **Enthalpy of formation of americium sesquioxide; systematics of actinide sesquioxide thermochemistry.** Morss, L.R.; Sonnenberger, D.C. (Argonne National Lab., IL (USA). Chemistry Div.). *Journal of Nuclear Materials;* **130**: 266-272(Feb 1985). (CONF-840807—). Contract W-31-109-ENG-38.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The enthalpy of formation of hexagonal Am_2O_3 at 298.15 K has been determined to be -1690.4 +- 7.9 kJ mol^{-1} by solution microcalorimetry. Systematic comparison of the measured enthalpies of formation of hexagonal Pu_2O_3 and Am_2O_3m monoclinic Cm_2O_3, and all lanthanide sesquioxides has been utilized to develop a predictive understanding of stability relationships among all actinide sesquioxides and other actinide species.

44679 **Chemical thermodynamic representations of <PuOsub(2-x)> and <Usub(1-z)Pu sub(z)Osub(w)>.** Besmann, T.M.; Lindemer, T.B. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.). *Journal of Nuclear Materials;* **130**: 489-504(Feb 1985). (CONF-840807—). Contract AC05-84OR21400.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

All available oxygen potential-temperature-composition data for the calcium fluorite-structure <PuOsub(2-x)>sup(**) phase were retrieved from the literature and utilized in the development of a binary solid solution representation of the phase. The data and phase relations are found to be best described by a solution of [Pu sub(4/3)O_2] and [PuO_2] with a temperature dependent interaction energy. The fluorite-structure <Usub(1-z)Pu sub(z)Osub(w)> is assumed to be represented by a combination of the binaries <PuOsub(2-x)> and <UOsub(2+-x)>, and thus treated as a solution of [Pusub(4/3)O_2], [PuO_3], [UO_3], and either [U_3Osub(4.5)] or [U_3O_7]. The resulting equations well reproduce the large amount of oxygen potential-temperature-composition data for the mixed oxide system, all of which were also retrieved from the literature. These models are the first that appear to display the appropriate oxygen potential-temperature-composition and phase relation behavior over the entire range of existence for the phases.

44680 **Conduction electron density of states and proton spin-lattice relaxation in the dihydrides of scandium, yttrium, lanthanum and lutetium.** Torgeson, D.R.; Lu, L.T.; Phua, T.T.; Barnes, R.G.; Peterson, D.T. (Ames Lab., IA (USA)); Seymour, E.F.W. (Warwick Univ., Coventry (UK). School of Physics). *Journal of the Less-Common Metals;* **104**: No. 1, 79-86(3 Dec 1984). (CONF-8404106—).

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

The authors report determinations of the proton Korringa product Tsub(1e)T in the dihydride phases of scandium, yttrium, lanthanum and lutetium based on samples prepared from the highest purity metals available in the Ames Laboratory and in addition in some cases utilizing the technique of partial deuteration to suppress further the paramagnetic impurity contribution to the spin-lattice relaxation rate. It is concluded that the quantity (Tsub(1e)T) sup(-1/2), which is essentially proportional to the electronic density of states, has the value 0.055 +- 0.002 ssup(-1/2) Ksup(-1/2) at the dihydride composition in all systems. The dependence of (Tsub(1e)T) sup(-1/2) on hydrogen concentration within the dihydride phase appears to be weak; however, in LaHsub(x), (Tsub(1e)T) sup(-1/2) decreases substantially for $x > 2$. The implications of these results for relative s and d band contributions and hyperfine fields are discussed in the light of recent low temperature heat capacity measurements.

44681 **Paramagnetic impurity effects in nuclear magnetic resonance determinations of hydrogen diffusion and electronic structure in metal hydrides: cerium in YH_2.** Phua, T.T.; Torgeson, D.R.; Barnes, R.G.; Schoenberger, R.J.; Peterson, D.T. (Ames Lab., IA (USA)); Belhoul, M.; Styles, G.A.; Seymour, E.F.W. (Warwick Univ., Coventry (UK). School of Physics). *Journal of the Less-Common Metals;* **104**: No. 1, 105-112(3 Dec 1984). (CONF-8404106—).

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

The authors report the results of a preliminary survey of the effects on the proton spin-lattice relaxation time T_1 resulting from the presence of controlled low levels of the Kramers ions cerium, neodymium, gadolinium, dysprosium and erbium in YH_2. The Ce^{3+} results in particular are presented in some detail because the cerium ion behaves very differently from the others, reflecting the fact that it is an extremely 'fast relaxing' ion. From the measured proton T_1 it is concluded that the Ce^{3+} ion spin-lattice relaxation time is 1.65 x 10^{-12} s at 77 K.

44682 **Hydrogen bombardment of the oxide layer on beryllium.** Bastasz, R. (Sandia National Labs., Livermore, CA (USA)). *Thin Solid Films;* **121**: No. 2, 127-133(16 Nov 1984). (CONF-8404135—).

From International conference on metallurgical coatings; San Diego, CA, USA (9 Apr 1984).

Beryllium is being considered as a plasma-side material of low atomic number Z for use in fusion reactors. Untreated beryllium surfaces are usually covered by a thin oxide layer which forms during air exposure or from residual gas adsorption in vacuum. Secondary ion mass spectrometry measurements have been made to investigate the durability of this oxide layer during hydrogen ion bombardment at an energy of 1 keV, which is similar to that expected at the plasma edge in a fusion reactor. The surface condition of machined beryllium samples undergoing hydrogen bombardment was monitored by observing secondary ion emission of O^-, OH^- and BeO^-. On the basis of sputtering yield data for BeO, the oxide layer appears to be up to 10^2 monolayers in thickness. At the metal interface it was possible to determine the cross section for the removal of adsorbed oxygen. The measured value is 1.5 x 10^{-17} cm^2, which is in agreement with bulk oxide sputtering data. This suggests that adsorbed oxygen forms a surface oxide with a binding energy that is similar to that of the bulk oxide. These results are used to predict the conditions in which an oxide layer will exist on exposed beryllium surfaces during fusion reactor operation.

44683 **Electronic structure of γ phase zirconium hydride.** Switendick, A.C. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of the Less-Common Metals;* **103**: No. 2, 309-315(15 Nov 1984). (CONF-8404106—).

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

The electronic energy band structure of γ phase ZrH has been calculated. This can be related to the cubic phase by the ordered removal of four hydrogen atoms from the large cubic unit cell. Very non-rigid band behavior is obtained. New structure is induced in the density of states which is not present in the original phase. A peak occurs at the Fermi energy which may be responsible for the tetragonal distortion but is insufficient to account for the observed magnetic susceptibility.

44684 **Self-consistent band structure calculations of titanium, zirconium and hafnium dihydrides.** Papaconstantopoulos, D.A. (Naval Research Lab., Washington, DC (USA)); Switendick, A.C. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of the Less-Common Metals;* **103**: No. 2, 317-324(15 Nov 1984). (CONF-8404106—).

From International symposium on the properties and applications of metal hydrides; Eilat, Israel (9 Apr 1984).

The authors performed self-consistent augmented plane wave calculations of the electronic energy band structure of cubic TiH_2, ZrH_2 and HfH_2. Although qualitatively similar to previous studies, these calculations show large quantitative differences. Differences are found in the ordering of energy levels, the Fermi level (FL) values of the density of states (DOS) and the characteristic bandwidths. The tetragonal distortion observed at stoichiometry makes

detailed comparison with experiment tenuous; however, these calculations are in better agreement with the photoelectron data than are the non-self-consistent calculations. The electron-phonon interaction eta was also calculated in these materials and it was found that, although the DOS at the FL is much larger than that in PdH, the quantity eta on the hydrogen sites is much smaller and therefore, these compounds are not superconductors.

44685 **Selection and qualification of materials for relative motion and electrical isolation in a vacuum environment.** Trester, P.W.; McKelvey, T.E.; Doll, D.W.; Sevier, D.L. (GA Technologies, Inc., San Diego, CA (USA)); Ulrickson, M.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Thin Solid Films;* **119**: No. 1, 113-120(7 Sep 1984). (CONF-8404135—).

From International conference on metallurgical coatings; San Diego, CA, USA (9 Apr 1984).

Coefficient of friction and wear rate were determined under conditions of reciprocative sliding in vacuum for a number of state-of-the-art hard coatings, including oxides, nitrides and carbides. These materials were tested in contact with one another and against the alloys Inconel 718 and Nitronic 60. For some selected conditions, similar tests were conducted in air to enable environmental influence to be assessed. The program also investigated cyclic compression loading of coated surfaces against uncoated Inconel 718. The results are reported and were used to select and qualify coating materials for limiter component applications that operate both in vacuum and in low pressure hydrogen at elevated temperature in the tokamak fusion test reactor.

3603 Composite Materials

REFER ALSO TO CITATION(S) 44601, 44905, 44906

44686 **(CONF-8506171—1) Preparation of ceramic fiber-ceramic matrix composites by a faster chemical vapor infiltration process.** Caputo, A.J.; Lackey, W.J.; Stinton, D.P. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016402.

From 5. European conference on CVD; Uppsala, Sweden (17 Jun 1985).

A new, faster process was developed for the fabrication of ceramic fiber-reinforced, ceramic-matrix composites by chemical vapor infiltration. Process and equipment improvements led to the fabrication of preforms with a higher fiber content, and infiltration improvements led to reduced infiltration run times and increased infiltrated densities. These improvements have produced composites with not only higher flexural strengths but also high strain values. The high strain values have been a goal of this work. 23 refs., 8 figs.

44687 **(DOE/OR/21400—T100) Fiber-reinforced ceramic composites made by chemical vapor infiltration.** Caputo, A.J.; Lowden, R.A.; Stinton, D.P. (Oak Ridge National Lab., TN (USA)). [1985]. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015587.

A process was developed for the fabrication of ceramic-fiber-reinforced ceramic-matrix composites by chemical vapor infiltration. The ceramic composites were prepared by making fibrous preforms from multiple layers of SiC cloth and forming the silicon-carbide matrix for each component specimen by infiltrating the fibrous preform by a chemical vapor deposition process. A major goal of the work was achieved when infiltration was accomplished in hours instead of weeks by combining the thermal-gradient and forced-gas-flow techniques. Composites that possessed moderate flexural strength and high strain to failure were produced. In addition, the strength of the composites decreased gradually after the maximum strength was obtained, demonstrating that the composites had the desired high toughness and avoided the typical brittle behavior of monolithic ceramics.

44688 **(UCRL—15708) Damage progression in fiber composites during repeated loading. Final report.** Hamstad, M.A. (Denver Univ., CO (USA). Dept. of Engineering). 15 Apr 1985. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017282.

Preliminary tests to study the damage progression during load cycling of Kevlar 49/epoxy tensile strands are reported. Only a preliminary analysis of the data was accomplished.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 44741, 45837, 45838, 45840, 45840

44689 **(AD-A—954462/8/XAB) Radiation damage to plastics and coated fabrics - 1.** Johnson, R.E.; Sicilio, F. (General Dynamics Corp., Fort Worth, TX (USA). Nuclear Aerospace Research Facility). 23 Jan 1958. 56p. (NARF—58-5T; MR-N—175). NTIS, PC A04/MF A01.

Various plastics, plastic laminates, fabric laminates, glass cloth laminates and a fabric were irradiated in October 1955 using the Ground Test Reactor at Convair-Fort Worth. The specimens were subjected to an average integrated fast-neutron flux of 6×10^{14} nvt, an averagfe integrated thermal-neutron flux of 6×10^{13} nvt, and an average integrated gamma flux of 5×10^{16} gammas/sq cm. After irradiation, tests were performed on irradiated and control samples of detect changes in physical properties resulting from the irradiation. The properties which showed most change were tensile strength, elongation, compressive and flexural strength, hardness, and tear strength. However, a trend in the changes was not discernible; for example, in some cases tensile strength was increased, and in samples of the same type materials, a decrease was noted. The samples displayed few changes in thermal expansion, dielectric constant, surface resistivity, and loss tangent.

44690 **(DTH-ABK-S—37) Fatigue testing of glassfiber-reinforced polyester.** (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner). 1982. 29p. (In Danish). Denmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner.

EFP.

Glassfiber-reinforced polyester samples of windmill wing beams were tested for fatigue, wear, pressure stress etc. Fatigue tests were accomplished in a 10 Mp Amsler high-frequency pulsator.

44691 **(JINR—18-83-468) Nuclear ultrafilters.** Apel', P.Yu.; Kuznetsov, V.I.; Zhitaryuk, N.I.; Orelovich, O.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701864.

Submitted to the journal Collod J. .

Etching of micropores with diameteres from 0 up to 1000 A in polyethyleneterephthalate (PET) films 5 μm and 10 μm thick irradiated by xenon ions was investigated. It is shown that the xenon track etching rate is by 3-4 orders of magnitude higher than the bulk etching rate in dilute alkali solutions at 80 deg C. It has been revealed that the radial etching rate in alkali solution of low concentration increases with radius r as an dr/dt approximately exp(-const/r). Ultrafilters with the pore diameters from 150 up to 800 A were made by chemical treatment of the films with the (2-3) x 10^9 cm^{-2} track densities. The investigation of their structure was performed using an electron microscope. The ultrafilters with the smallest pores are characterized by the greatest diameter dispersion (about 15%). This is caused by the effect of polycrystalline structure of PET. Specific through-put of distilled water for samples of different ultrafilters was measured.

44692 **(SAND—85-0839C) Optical absorption as a sensitive monitor of tensile strength loss in thermally aged nylon 6,6.** Renschler, C.L. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 4p. (CONF-850942—14). NTIS, PC A02. File Number DE85011518.

From 190. American Chemical Society national meeting; Chicago, IL, USA (8 Sep 1985).

Chemical changes which take place in polymers during thermal aging often adversely affect the bulk physical properties of the material. Aging rates under ambient conditions are usually so slow as to require extremely long aging cycles to achieve measurable losses in such properties as tensile strength. Therefore, accelerated aging under more stressful conditions (e.g., higher temperatures) with Arrhenius-plot extrapolations to ambient conditions is often employed. Since this scheme requires that there is no change in the predominate aging mechanism at higher temperatures, one would prefer to increase the sensitivity of aging detection so one could measure aging at lower temperatures on a reasonable time scale. We describe here the use of optical absorption spectrophotometry as a sensitive monitor of thermal aging in nylon 6,6 which correlates with tensile strength loss. 8 refs., 3 figs.

44693 **(SAND—85-1030) Extension of electronic transport properties of polymer dielectrics to severe environments encountered in systems.** Kurtz, S.R. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017321.

The factors that determine the level of radiation-induced conductivity in polymer dielectrics are summarized. These concepts are extended into high-dose radiation environments, beyond the range of our present data. This report provides an introduction of this field to researchers dealing with these effects in systems.

44694 (UCID—19323-84-3, pp 40-49) **Methodology for determining mechanical properties of polymers.** Feng, W.W.; Christensen, R.M. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

The goal of this project is to develop a method for predicting the time-dependent mechanical behavior of polymeric materials. To achieve that goal, we are modeling the effects of short-term aging on the elastic and viscoelastic properties of polymers. Our emphasis is on the prediction of long-term effects from short-term experiments. During FY84 we designed and built the experimental apparatus for inflating a plane circular membrane for both long- and short-term aging tests. In theoretical work, we obtained the solution for deformations of an axisymmetric nonlinear polymeric membrane and developed an approximate analysis that resulted in a closed-form solution. The theoretical result yielded a relationship between the deformation of the membrane and the inflating pressure when the material properties were given. We used the experimental results to demonstrate the validity of the theoretical calculations and, conversely, to determine the material properties of the polymers. Since the material properties were usually functions of the aging histories of the polymers, the effects of aging could also be determined.

44695 **Role of long-wavelength degrees of freedom in the rod-to-coil transition in polymers.** Goldenfeld, N.; Halley, J.W. (Institute for Theoretical Physics, University of California at Santa Barbara, Santa Barbara, California 93106). *Physical Review Letters;* 55: No. 7, 730-733(12 Aug 1985). Contract FG03-84ER45108.

We present a model of the rod-to-coil transformation in a single-stranded polymer which includes the effects of long-wavelength degrees of freedom in the straight parts of the chain. The model exhibits a true first-order phase transition in qualitative agreement with the results of an experiment.

44696 **(LA-tr—85-37) Procedure for the production of linear thermoplastic polymers from the breakdown products of pyrolysis of p-xylene-bis-sulfones.** (Union Carbide Corp., New York (USA)). 1985. Contract W-7405-ENG-36. Translation of Dutch Patent No. 6,411,019, September 1964. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017024.

This invention concerns the analysis of p-xylene-bis-sulfones. The invention concerns in particular the pyrolytic analysis of p-xylene-bis-sulfones and the polymers prepared by this process. Purpose of this invention is also to create p-xylylene polymers, where the vulnerable hydrogen atoms lying on the border of the aromatic ring are replaced by another more stable substitute, which increases the total stability of the polymers. Another object of the invention is to create a procedure for the preparation of p-xylylene polymers by suitable means. Another object of the invention is to produce $\alpha,\alpha,\alpha',\alpha'$-tetrafluor-p-xylylene polymers.

3606 Other Materials

REFER ALSO TO CITATION(S) 43996, 44000, 44009, 44014, 44022, 44057, 44240, 44633, 44639, 44689, 44770, 44774, 44795, 44891, 44892, 44916, 45407, 45728

44697 **(AD-A—154364/4/XAB) Catalog of Corps of Engineers structure inventories suitable for the acid precipitation-structure materials study. Special report.** Merry, C.J.; McKim, H.L.; Humiston, N.H. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Mar 1985. 44p. (CRREL-SR—85-1). NTIS, PC A03/MF A01.

This report contains a survey of Corps of Engineers floodplain inventories. Its purpose was to determine if enough building materials information was available in the Corps data base to be used for predicting the distribution of building materials across the country as part of the EPA acid rain assessment program. The floodplain surveys were rated using the criteria of the date of the survey, the number of buildings, the variety of building materials, the amount of dimensions data listed for the buildings, the land cover types in the data, and whether or not the data were computerized. Six structure inventories were recommended for further study.

44698 **(CEA-CONF—7392) Radiation damage in SmS, SmSsub(1-x)Psub(x) and SmB_6.** Morillo, J.; Bordier, G.; de Novion, C.H.; Senateur, J.P.; Jun, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Aug 1984. 14p. (CONF-840876—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751188.

From International conference on valence fluctuations; Koln, F.R. Germany (27 Aug 1984).

Large conductivity increases under 21 K electron or neutron irradiations are observed in SmS and SmSsub(1-x)Psub(x). It is shown that they are related to Sm defects. A possible mechanism is 4f electron delocalization around radiation defects. In SmB_6, the low temperature resistivity increase desappears under 21 K irradiation. The thermal stability of the defects is also investigated up to room temperature.

44699 **(CEA-CONF—7405) Influence of the leaching mode on the durability of a glass for fission product containment.** Nogues, J.L.; Terki, A. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Jun 1984. 14p. (In French). (CONF-8406263—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751159.

From Congress on glass and water; Brussels, Belgium (14 Jun 1984).

The chemical durability of a glass containing wastes from light water reactor (LWR) has been studied with three different lixiviation modes: "static" leach test, "soxhlet" test and "continuous flow" test. After a description of these tests, the leaching mode influence on the glass durability is reported as obtained from weight loss measurements, analyses of the leaching solutions and surface analyses of the samples. Finally, the corrosion mechanisms of this type of glass are approached and a phenomenological explanation of attack from an aqueous solution is proposed.

44700 **(CEA-CONF—7406) Application of ultramicrotome section technique to the characterization of nuclear glass durability.** Nogues, J.L.; Thomassin, J.H.; Touray, J.C. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Jun 1984. 15p. (In French). (CONF-8406263—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751158.

From Congress on glass and water; Brussels, Belgium (14 Jun 1984).

Surface corrosion of four different glasses was studied by electron microscopy. After static leaching at 90°C by bidistillate water for 3 months samples are embedded in resin and sections 500

A thick are cut perpendicular to glass surface for examination. Results obtained are discussed in function of chemical composition.

44701 **(CEA-CONF—7479) Fluorescence emission by molecular impurities in irradiated and non-irradiated silica.** Boisde, G.; Carvalho, W.; Dumas, P.; Neuman, V. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Aug 1984. 6p. (CONF-840872—34). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752056.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

In order to gain a better understanding of the optical behaviour of silica irradiated by Co 60 (dry, OH and F-doped) two spectroscopic methods are used. In the first case an Ar.F laser emitting at 193 nm excites perform samples and the fluorescence is examined between 400 and 1000 nanometers. In the second case fibers drawn from these preforms were excited using an Ar^+ laser and examined with a Raman microprobe in the various doped zones. The emission spectra confirm that O_2 molecule complexes contribute to the optical spectra of pure silica samples. The presence of fluorine as a dopant seems to be associated to an emission band around 600 nm whose nature is so far unknown. Optical fibers provide a convenient means of both carrying information and sensing remote areas in radiation-plagued environments. One major difficulty lies in the fact that the performances of fibers can degrade seriously due to the large increase in their attenuation under irradiation.

44702 **(CEA-CONF—7677) Molecular dynamic study of defects created by irradiation in vitreous silica.** Doan, N.V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1984. 1p. (In French). (CONF-8410280—1-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752054.

From Autumn meeting on metallurgy; Paris, France (23 Oct 1984).

Published in summary form only.

44703 **(CONF-840764—7) EXAFS studies of metamict materials.** Greegor, R.B.; Lytle, F.W.; Ewing, R.C.; Haaker, R.F. (Boeing Co., Seattle, WA (USA); New Mexico Univ., Albuquerque (USA). Dept. of Geology). 1984. Contract FG06-84ER45121. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85014041.

From 3. international EXAFS conference; Stanford, CA, USA (16 Jul 1984).

An important approach in the evaluation of crystalline wasteforms for nuclear waste storage is to study the long term stabilities of closely related radioactive mineral species which have become metamict (radiation damaged) and have been exposed to weathering processes for geologic periods of time. The metamictization and alteration effects can then be used for comparison with the results of short term laboratory leaching and irradiation experiments which have been designed to simulate long term effects. Phosphates, the Ti-Nb-Ta complex oxide minerals and various selected silicates are natural analogues for phases in proposed radioactive wasteforms. Because of the geochemical similarities with wasteforms, a study of the metamict state and annealing in complex mineral phosphates, silicates and oxides will yield data that is important in evaluating the long term stability of radioactive wasteforms. The investigation reported here is an application of EXAFS and XANES spectroscopy to the study of the structure of the metamict state. The nearest neighbor environment of Ti and Ca in metamict AB_2O_6-type complex oxides has been examined using SSRL Beam Line VII-3 in order to evaluate the effect of alpha-recoil damage on these structures. Comparison of the EXAFS/XANES data for metamict samples with data for annealed and crystalline samples suggests minor changes in the first coordination sphere, Ca-O or Ti-O, (a slight decrease in coordination number and bond lengths, and increased distortion of the coordination polyhedron), but major disruption of the second coordination sphere, for the material in the metamict state. These data suggest a mechanism for the transition from the crystalline to the metamict state in which tilting of cation coordiantion polyhedra is a possible effect of damage caused by alpha-recoil events.

44704 **(CONF-850813—2) Ion damage calculations in crystalline silicon.** Oen, O.S. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016931.

From 11. international conference on atomic collisions in solids; Washington, DC, USA (4 Aug 1985).

Damage profiles in crystalline silicon produced by light (B) and heavy (Bi) ions with energies from 10 to 100 keV were studied using the computer program MARLOWE (version 12). The program follows not only the incident ion collision by collision, but also any Si target atom that is set into motion through an energetic collision. Thus, the transport effect of the complete cascade of recoiled target atoms is included in the damage profile. The influence of channeling was studied for Si(100) using beam tilt angles from the surface normal of 0°, 3° and 7° about the [001] or [011] axes. The effects of channeling on the damage profile are twofold: first, there is a large reduction of the central damage peak; second, there is a component of the damage profile that extends considerably deeper into the target than that found in conventional studies using a random target assemblage. The influence of amorphous overlayers of SiO_2 on the damage and implantation profiles in the Si(100) substrate has also been investigated.

44705 **(CONF-8506108—2) Fracture toughness of anisotropic graphites.** Kennedy, C.R.; Kehne, M.T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016595.

From 17. biennial conference on carbon; Lexington, KY, USA (16 Jun 1985).

Fracture toughness measurements have been made at 0, 30, 45, 60, and 90° from the extrusion axis on a reasonably anisotropic graphite, grade AGOT. It was found that the fracture toughness did not vary appreciably with orientation. An observed variation in strength was found to be the result of defect orientation.

44706 **(EPRI-EL—4181) Polysil structures. Final report.** Ford, W.Y. (Hughes Supply, Inc., Orlando, FL (USA)). Aug 1985. 170p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920812.

Design analyses, supported by laboratory experiments, have shown the technical feasibility of building a large insulating structure from Polysil, a polymer concrete. Using the information provided in this report, researchers should be able to design and build Polysil products such as 138-kV transmission poles and substation bus supports.

44707 **(FRNC-TH—1614) Spatial distribution of defects created along the trajectory of an ion in cellulose triacetate.** Vareille, J.C. (Limoges Univ., 87 (France)). Jun 1982. 227p. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number DE85751157.

The study of the triacetate as a solid trace detector shows the importance of the morphology of the trace (latent and/or revealed). The spatial distribution of defects created along the trajectory of an ion is demonstrated by electron microscopy and by the proposition of a theoretical model based on the study of the cellulose radicals created. Then the structure of the zone perturbed by an ion is given.

44708 **(INIS-mf—9714, pp 10) Physical properties of transition metal chalcogenides.** Gruber, H.; Krautz, E. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). Nov 1984. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781213.

Published in summary form only.

In Progress report 1983/1984 of the Solid State Institute of the Technical University of Graz.

44709 (INIS-mf—9740, pp 105) **ESR and magnetic susceptibility studies of graphite intercalated with transition metal hexafluorides.** Selig, H. (Hebrew Univ., Jerusalem (Israel)); Vaknin, D.; Davidov, D. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Yeshurun, Y. (Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Physics). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44710 (INIS-mf—9740, pp 103) **Effect of partial pressures on mass transport of CdTe by VUVG.** Yellin, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Ben-Dor, L. (Hebrew Univ., Jerusalem (Israel)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44711 (INIS-mf—9740, pp 104) **Low temperature synthesis of pseudobinary chalcogenides.** Ben-Dor, L. (Hebrew Univ., Jerusalem (Israel)); Yellin, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44712 (Juel-Conf—49, pp 3-5) **Properties and applications of coke-mix materials.** Luhleich, H.K.; Binkele, L.; Delle, W.; Dias, F.J.; Haag, G.; Kampel, M. Jun 1984. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). (CONF-8407143—Exc.).

From International carbon conference; Bordeaux, France (2 Jul 1984).

With 6 posters in annex.

Some results of a material study using petroleum- and pitch-coke as filler materials and a phenolic resin as a binder in the range of 10 wt.% binder content to 40 wt.-% are given. Objective of this paper is development, irradiation testing and performance of materials for sliding ring seals to be used in the bearing and drive unit of the spallation neutron source.

44713 **(Juel-Conf—49) Carbon 84.** Delle, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Jun 1984. 24p. (CONF-8407143—Exc.). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.).

From International carbon conference; Bordeaux, France (2 Jul 1984).

This report is the compilation of some papers prepared by KFA JUELICH GmbH for the International Carbon Conference CARBONE 84, which will be held at Bordeaux/France. The presentations deal with objectives of manufacture as well as technical and nuclear applications of carbonous materials.

44714 (Juel-Conf—49, pp 6-11) **Carbon materials for sliding ring seals.** Delle, W.; Schulze, R.E.; Hofmann, M.; Victor, K.H. Jun 1984. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). (CONF-8407143—Exc.).

From International carbon conference; Bordeaux, France (2 Jul 1984).

Besides silicon carbide with excesses of silicon and/or carbon, special sliding carbons with various impregnations (i.e. C or Sb) are under consideration for application. In order to provide back-up materials particularly with a view to satisfactory irradiation behaviour, developments are being performed at KFA Juelich.

44715 (Juel-Conf—49, pp 20-24) **Irradiation induced creep in graphite with respect to the flux effect and the high fluence behaviour.** Cundy, M.R.; Kleist, G.; Mindermann, D. Jun 1984. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). (CONF-8407143—Exc.).

From International carbon conference; Bordeaux, France (2 Jul 1984).

In accelerated irradiation creep tests, performed in the HFR Petten, in a fast neutron flux of about 2 x 10^4 cm^{-2} s^{-1} and at temperatures of 300 and 500°C, a fast neutron fluence in excess of 20 x 10^{21} cm^{-2} (EDN) has been attained so far. As a supplement to this, an analogous creep test was conducted in a fast neutron flux lower by a factor of four which is more typical for the service conditions in a HTR, with a maximum fast fluence of only 4 x 10^{21} cm^{-2} (EDN). This experiment was aimed at answering the question if, for equal fast fluence, enhanced irradiation creep and Wigner dimensional change would take place in a reduced fast neutron flux. This problem has more generally been addressed to as the "flux effect" or the "equivalent temperature concept".

44716 (LA—10227-C-Vol.2, pp 430-455) **One-body density matrix and the momentum density in ^{4}He and ^{3}He.** Whitlock, P.A.; Panoff, R.M. (New York Univ., New York). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2). Contract AC02-76ER03077.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The one-body density matrix and the momentum density for liquid and solid ^{4}He, determined from Green's Function Monte Carlo calculations using the HFDHE2 pair potential, are described. Values for the condensate fraction and the kinetic energy derived from these calculations are given and compared to recent experimental results. Preliminary results from variational Monte Carlo calculations on n(r) and n(k) for liquid ^{3}He are also reported.

44717 **(LA-UR—85-2440) Use of electrical conductivity experiments to study the phase diagram of carbon.** Mitchell, A.C.; Shaner, J.W.; Keeler, R.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-850759—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015718.

From 10. high pressure conference on research in high pressure science and technology; Amsterdam, Netherlands (8 Jul 1985).

Recent theoretical and experimental work on the properties of carbon at very high pressures indicates that the diamond phase may dominate the carbon phase diagram. The work of Yin and Cohen indicates that diamond may be the stable carbon phase to pressures as high as 20 Mbar. Recent work by Shaner, et al. is compatible with solid diamond on the Hugoniot at pressures up to 1.4 Mbar. Using previously developed techniques, we have carried out conductivity measurements on shock-compressed graphite to pressures in excess of 600 kbar and temperatures up to 5000°K. No diamond - liquid transition was observed under the experimental conditions achieved.

44718 **(SAND—84-2487C) Effect of hydrostatic pressure on defect annealing in semiconductors.** Barnes, C.E.; Samara, G.A. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850421—14). NTIS, PC A02. File Number DE85015149.

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

We report the first study of the effect of hydrostatic pressure on the annealing of defects in Si and GaAs. It is shown that the application of hydrostatic pressure enhances the annealing rate in these materials. Analysis of the data yields the lattice volume relaxation accompanying annealing.

44719 (UCID—19323-84-3, pp 13-18) **Precision contour grinding development.** Bryan, J.B.; Carter, D.L. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Large, complicated, aspherical optical elements of glass are presently used in many astronomical devices, both on land and in space. Grazing-incidence mirrors are envisioned for use in such missions as the proposed Advanced X-Ray Astrophysical Facility (AXAF), the Far Ultraviolet Spectroscopic Explorer (FUSE), and others. These elements are very expensive to fabricate because a great deal of time and labor are required to shape a glass blank to a point where precise polishing can begin. To alleviate this problem,

the Fabrication Technology Section set up a project to develop and demonstrate an improved fabrication process. After reviewing various options for glass removal, we changed from precision grinding to single-point diamond crushing. Diamond crushing uses the natural point of a diamond to crush the brittle substrate. This process is an attractive alternative to grinding because less equipment is required to prepare a machine and there is very little tool wear. In our demonstration we achieved a surface finish of 50 μin. peak-to-valley, with occasional deeper pits, on Zerodur glass and BK-7 glass.

44720 **(UCRL—15707) Optical characterization of nonlinear crystals. Final report, January 15, 1984-September 30, 1984.** DeShazer, L.G. (Hughes Research Labs., Malibu, CA (USA)). Jan 1985. Contract W-7405-ENG-48. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017270.

Crystals of the potassium dihydrogen phosphate (KDP) group are widely used in laser technology. These tetragonal isomorphs have the composition MH_2XO_4, where M may be K, Rb, Cs or NH_4; X may be P or As; and H may be replaced by deuterium D, fully or partially. They encompass sixteen crystals potentially useful state-of-the-art nonlinear optical devices. Refractive indices and their thermal variations were measured for twelve KDP isomorphs. These parameters are needed to establish the phase matching geometry and thermal behavior of a nonlinear crystal in the frequency upconversion operation in high-power laser systems.

44721 **(UCRL—91430) Variation of transmittance spectra of porous antireflection coatings with index profile.** Milam, D.; Peterson, G.G. (Lawrence Livermore National Lab., CA (USA)). 30 May 1985. Contract W-7405-ENG-48. 36p. (CONF-8510101—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85013976.

From Boulder damage symposium; Boulder, CO, USA (15 Oct 1985).

Transmittance spectra were calculated for single-layer coatings with (1) homogeneous refractive index, (2) index profiles that increase monotonically with distance into the coating, and (3) index profiles that rise in discrete steps. The calculations predict that large transmittance at tuned wavelengths can be obtained using any of these coating designs and known, porous silica coating materials. The spectral bandwidth of transmittance maxima increases when the index profile is altered from homogeneous to any profile whose index increases monotonically with thickness in the coating. Bandwidth is greatest for the linear-ramp coating whose index rises linearly from that of air to that of the substrate, but this design cannot currently be used because we are unable to fabricate silica coating material with the extremely large porosity needed to provide a coating index near unity at the air interface. For currently attainable fractional silica contents, estimated to be in the range 0.4 to 0.5, the optimum bandwidth is provided by a coating with a single discrete step in its index profile.

44722 **(UCRL—92936) One dimensional polaron effects and current inhomogeneities in sequential phonon emission.** Hellman, E.S.; Harris, J.S.; Hanna, C.; Laughlin, R.B. (Stanford Univ., CA (USA). Stanford Electronics Labs.; Stanford Univ., CA (USA). Dept. of Radiology; Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 8p. (CONF-850774—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016128.

From International conference on hot electrons; Innsbruck, Austria (8 Jul 1985).

We have constructed a physical model to explain the tunneling current oscillations reported by Hickmott et al., for GaAs/AlGaAs heterostructures in high magnetic fields. We propose that the periodic structure observed is due to space charge which builds up in the undepleted layer when electrons enter it with energy just below the phonon emission threshold. Such electrons interact with the lattice to form polarons whose energy is pinned to the phonon energy, and thus has a very small group velocity. The polaron effect is strongly enhanced by the confinement of the electrons by the strong magnetic field. We infer from the current-voltage data that most of the tunneling current flows through a small area of the sample. The combined model gives reasonable quantitative agreement with experiment. 6 refs., 6 figs.

44723 **Light-induced excess conductivity and the role of argon in the deposition of doping-modulated amorphous silicon superlattices.** Su, F.; Levine, S.; Vanier, P.E.; Kampas, F.J. (Department of Materials Science and Engineering, State University of New York, Stony Brook, New York 11794). *Applied Physics Letters;* **47**: No. 6, 612-614(15 Sep 1985). Contract AC02-76CH00016.

Amorphous silicon pnpn ... structures that exhibit the phenomenon of light-induced excess conductivity (LEC) have been deposited in a single-chamber glow discharge deposition system by simple control of gas flows. This phenomenon is negligible when the doped silane is undiluted but clearly evident when the silane is diluted in argon. Experiments were performed in which argon dilution was only used for specific regions of the structure. The LEC effect was found to occur if argon dilution was used during the deposition of any fraction of the superlattice layers. These experiments rule out mechanisms requiring phosphorus-boron defect complexes or interface states.

44724 **UV laser incorporation of dopants into silicon: Comparison of two processes.** Fogarassy, E.P.; Lowndes, D.H.; Narayan, J.; White, C.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Applied Physics;* **58**: No. 6, 2167-2173(15 Sep 1985). Contract AC05-84OR21400.

The incorporation properties of implanted or deposited Sb into the Si lattice as a result of irradiation with a pulsed KrF ultraviolet laser have been compared. The surface melting dynamics resulting from laser irradiation have been studied in both cases by time-resolved optical reflectivity. The distribution profiles of the Sb, deduced from Rutherford backscattering spectrometry and ion channeling measurements, show in both cases a maximum substitutional concentration of 2.1×10^{21} cm^{-3}. Substitutional solubility is limited by interface instabilities which develop during regrowth and lead to the formation of a well-defined cellular structure, as shown by transmission electron microscopy. For the deposited case, we observe a much larger cellular microstructure in addition to the cells induced by interface instabilities. The large cell structure may result from convection-induced instabilities.

44725 **Observation by EPR of trivalent hafnium in $LuPO_4$, YPO_4, and $ScPO_4$.** Abraham, M.M.; Boatner, L.A.; Ramey, J.O. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Chemical Physics;* **83**: No. 6, 2754-2758(15 Sep 1985). Contract AC05-84OR21400.

Recent EPR studies of the $4d^1$ configuration ion Zr^{3+} in the tetragonal-symmetry orthophosphate hosts $LuPO_4$, YPO_4, and $ScPO_4$, have led to additional investigations of d^1 configuration ions associated with unusual valence states of other elements. Single crystals of $LuPO_4$, YPO_4, and $ScPO_4$ doped with hafnium were grown and the electron paramagnetic resonance (EPR) spectrum of the $5d^1$ ion Hf^{3+} was observed in all three cases. EPR signals due to trivalent hafnium were only observed, however, when the doped samples were gamma irradiated at 77 K and maintained at 77 K during the EPR observations. Since there are two odd isotopes of hafnium with different nuclear spins and different natural abundances, identification of the spectrum of Hf^{3+} was straightforward. Since Hf^{3+} represents such an unusual valence for hafnium in the solid state, however, this identification was unequivocally verified by preparing crystals doped with isotopically enriched ^{179}Hf. The spectroscopic splitting factors, g/sub parallel/ and g/sub perpendicular/, and the parallel magnetic hyperfine constants A/sub parallel/ of ^{177}Hf and ^{179}Hf were obtained for Hf^{3+} in all three hosts. A determination of the hyperfine parameters with the applied magnetic field oriented in the perpendicular direction was not carried out due to quadrupole effects. As in the case of Zr^{3+}, the observed electronic g values for Hf^{3+} could not be accounted for by the standard second-order equations which included the spin-orbit-induced admixture of some other excited orbital levels of the d^1 configuration into the ground orbital level.

44726 **Enthalpy of formation of UF_4 by fluorine bomb calorimetry.** Johnson, G.K. (Argonne National Lab., IL (USA). Chemical Technology Div.). *Journal of Nuclear Materials;* **130**: 102-108(Feb 1985). (CONF-840807—).

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The energies of combustion in fluorine of two samples of uranium tetrafluoride, UF_4, were measured in a bomb calorimeter. Based on these measurements, the standard enthalpy of formation of crystalline UF_4, ΔHsub(f)°(UF_4, c, 298.15 K) = -1910.6 +- 2.0 kJ mol^{-1} was derived.

44727 **Microcalorimetric measurement of reaction enthalpies in solutions of uranium and neptunium compounds.** Schreiner, F.; Friedman, A.M.; Richards, R.R.; Sullivan, J.C. (Argonne National Lab., IL (USA). Chemistry Div.). *Journal of Nuclear Materials;* **130**: 227-233(Feb 1985). (CONF-840807—). Contract W-31-109-ENG-38.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The formation of complexes of uranyl and neptunyl (VI) ions with carbonate and hydrogen carbonate has been studied by titration microcalorimetry. The measurements were carried out with a computer-controlled microcalorimeter which is described in detail. Sample volumes are typically in the range of 1.5 to 2.5 ccm, containing about 0.05 millimole of the ionic species to be studied. The small volume renders the calorimeter useful for the measurement of uncommon and strongly radioactive substances. Enthalpies of reaction were obtained for the formation of the dicarbonato and the tricarbonato uranyl ions in a sulfate medium of ionic strength 1.6. The enthalpies are ΔH_3 = -39.6 +- 1 kJ/mol and ΔH_3 = -57.5 +- 1.5 kJ/mol, for the dicarbonato- and the tricarbonato-uranyl ions, respectively. The titration data for the neptunyl(VI) - carbonate system yield a value of ΔHsub(Np)-50 +- 2 kJ/mol for the tricarbonato-neptunyl ion when interpreted in analogy to the uranyl system.

44728 **Size quantization in small semiconductor particles.** Nozik, A.J.; Williams, F.; Nenadovic, M.T.; Rajh, T.; Micic, O.I. (Solar Energy Research Institute, Golden, CO; Boris Kidric Institute of Nuclear Science, Belgrade, Yugoslavia). *Journal of Physical Chemistry;* **89**: No. 3, 397-399(31 Jan 1985).

Optical effects due to size quantization in three dimensions have been observed for CdS and PbS colloids with particle diameters less than 50 A and 20 to 200 A, respectively. The optical absorption edge is blue shifted ~0.9 eV for the CdS colloid; for PbS colloids the shift is ~2 eV for particle diameters 20 to 30 A, and ~1 eV for particle diameters 50 to 200 A. The results are consistent with perturbation of the semiconductor band structure due to carrier confinement resulting in an increase in the effective band gap. 14 refs., 3 figs.

44729 **Measurement of adherence of residually stressed thin films by indentation. I. Mechanics of interface delamination.** Marshall, D.B.; Evans, A.G. (Rockwell International Science Center, Thousand Oaks, CA). *Journal of Applied Physics;* **56**: No. 10, 2632-2638(15 Nov 1984).

A fracture analysis of indentation-induced delamination of thin films is presented. The analysis is based on a model system in which the section of film above the delaminating crack is treated as a rigidly clamped disc, and the crack extension force is derived from changes in strain energy of the system as the crack extends. Residual deposition stresses influence the cracking response by inducing buckling of the film above the crack and by providing an additional crack driving force once buckling occurs. A relation for the equilibrium crack length is derived in terms of the indenter load and geometry, the film thickness and mechanical properties, the residual stress level and the fracture toughness of the interface. The analysis provides a basis for using controlled indentation cracking as a quantitative measure of interface toughness and for evaluating contact-induced damage in thin films.

44730 **Optical flatness standard.** Primak, W. (Argonne National Lab., IL). *Optical Engineering;* **23**: No. 6, 806-815(Nov-Dec 1984).

Matters relevant to preparing an optical flatness standard are discussed, such as selection of the material, surface preparation, bulk viscoelastic deformation, thermoelastic deformation, refractive errors, reduction of interferograms of plates examined in pairs, absolute calibration by intercomparison of two flats examined in two orientations, and the combination of several contours to obtain the figure of the plate. The contours are given as Fourier sine series expansions, and a technique for obtaining the coefficients is described.

44731 **Oxygen activity dependence of the defect structure of La-doped $BaTiO_3$.** Nasrallah, M.M.; Anderson, H.U.; Agarwal, A.K.; Flandermeyer, B.F. (Univ. of Missouri, Rolla). *Journal of Materials Science;* **19**: C1-C5(1984). Contract AC02-80ER10598.

A model for the behavior of donor-doped $BaTiO_3$ as a function of oxygen activity is proposed. Thermogravimetric measurements show good agreement with the proposed model. The results show that donor-doped $BaTiO_3$ is stoichiometric with electronic compensation of the donor at low oxygen activity, but with increasing oxygen activity, compensation becomes ionic as excess oxygen is absorbed. The possible compensation mechanisms are discussed.

44732 **Thermomechanical theory for a porous anisotropic elastic solid with inclusions.** Passman, S.L.; Batra, R.C. (Sandia National Labs., Albuquerque, NM). *Archive for Rational Mechanics and Analysis;* **87**: No. 1, 11-33(1984).

A mixture theory which describes a porous elastic anisotropic solid with inclusions was constructed. Thermal effects are taken into account. The theory is in accord with classical thermodynamics. Fully nonlinear isotopic and anisotropic materials are considered, and field equations are also given for a nontrivial special case which, though nonlinear, is controlled by a few material functions. When properly specialized, the theory reduces to the P-α model, a model widely used to describe porous solids.

44733 **Oxidation-reduction behavior of La-doped $SrTiO_3$.** Flandermeyer, B.F.; Agarwal, A.K.; Anderson, H.U.; Nasrallah, M.M. (Univ. of Missouri, Rolla). *Journal of Materials Science;* **19**: 2593-2598(1984). Contract AC02-80ER10598.

Thermogravimetric measurements as a function of oxygen activity were performed in the temperature range of 1200 to 1400°C on a series of lanthanum $SrTiO_3$ compounds. A model which assumes the absorption of excess oxygen in the structure which compensates the donors by formation of cationic defects is postulated. Comparison of this model with the experimental results show reasonable agreement.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

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44734 **(AD-A—154436/0/XAB) Evaluation of a high-pressure proportional counter for the detection of radioactive noble gases. Master's thesis.** Lucyshyn, W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). 10 Mar 1985. 86p. (AFIT/GNE/PH—85M-15). NTIS, PC A05/MF A01.

This study evaluates the potential of a newly constructed high-pressure proportional counter for the detection of radioactive noble gases. The detector was constructed from stainless and machinable ceramic, incorporating design recommendations from a previous study. A new gas-handling system was designed and constructed, incorporating a convective-flow purification tube filled with calcium turnings. External sources were used to characterize the performance of the detector using pure argon, argon quenched with varying amounts of methane, a binary mixture (80:20) of argon and xenon, and pure xenon as fill gases. Resolutions were measured as a function of anode voltage, and intrinsic efficiencies were calculated at the optimum resolutions. A radioactive gas sample was not

evaluated when it was found that the field tubes, as designed, did not eliminate the end effects in the detector causing the multiplication to vary along the length of the anode. Consequently, the resolution with an internal sample would not be adequate to perform the required analysis. Additionally, the purification process did not reduce the level of impurities in the available grade of xenon (99.9% pure) to produce useable spectra. Installation of new field tubes, prior to further evaluation of this system, is recommended.

44735 (AECL—8251) Measurement of natural uranium in urine by fluorometry. Kramer, G.H.; Johnson, J.R.; Green, W. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701968.

The fluorometric method of measuring natural uranium in urine that is currently used by the Bioassay Laboratory at Chalk River Nuclear Laboratories has been tested, optimized and documented. The method, which measures the fluorescence of uranium in a fused sodium fluoride pellet, has been shown to be quench independent and is routinely used to measure uranium concentrations in the range of 1 μg/L to 90 μg/L. The fluorimeter has a dynamic range of 0.2 μg/L to 200 μg/L.

44736 (AECL—8255) Determination of hafnium in zirconium metal and alloys by inductively coupled plasma using an algorithm for background correction. Hurteau, M.T.; Jarbo, G.; Mislan, J.P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1984. 17p. (CONF-8309347—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701943.

From 28. annual conference of the Spectroscopy Society of Canada; Ottawa, Ontario, Canada (1 Sep 1983).

Zirconium alloys are used for fabrication of core components in CANDU reactors, because of low capture cross-section for thermal neutrons coupled with favourable strength and corrosion resistance. Hafnium, which has similar chemical properties, is a deleterious impurity in zirconium used for alloy production because of its relatively high capture cross-section for thermal neutrons (about 300 fold greater) and must therefore be reduced to a low level (specification limit 50 $\mu g.g^{-1}$) by the refining process. We have shown that sequential plasma (inductively coupled argon) emission spectrometry is an effective technique for monitoring hafnium in zirconium near the specification limit using the special correction programs prepared for this analysis. Plasma emission spectrometry results compare favourably with those obtained by the neutron activation technique which has been used for the certification of standard reference materials.

44737 (CEA-CONF—7703) Coulometric determination of americium and curium for the preparation of reference solutions. Brossard, P.; Lafonta, S. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1984. 14p. (CONF-841210—24). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752061.

From International chemical congress of Pacific Basin Society; Honolulu, HI, USA (16 Dec 1984).

An improvement of the method for the determination of americium by coulometry is proposed in order to prepare standardized samples for alpha-spectrometry and mass spectrometry. The use of a microcomputer for automatic data acquisition and their numerical treatment is described. This method gives a precision of about 0,2% for 100 micrograms of americium (relative standard deviation of the mean, 95% confidence). The same technique is also suitable to prepare ^{244}Cm reference solutions.

44738 (CEA-R—5275) Elemental analysis of sediments and organisms from the Cape Verde abyssal plain (CV 1 and CV 2 sites). Germain, P.; Boust, D.; Sibuet, M.; Philippot, J.C.; Hemon, G. (Compagnie Generale des Matieres Nucleaires (COGEMA), Centre de la Hague, 50 - Cherbourg (France)). Aug 1984. 16p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751194.

Some 20 stable elements were determined by neutron activation analysis in epibenthic organisms and sediments from the Cape Verde abyssal plain. The levels measured in two Plesiopenaeus sp. (shrimp) individuals and one Barathrites sp. (fish) individual are similar to those found in others crustaceans and fish from oceanic and coastal areas. Concentration factors were calculated for the elements whose radioactive isotopes should be considered in the case of subseabed waste disposal (^{90}Sr, ^{135}Cs, ^{79}Se). The sediments are biogenous marly oozes. The levels measured reflect the variations of terrigenous inputs since the last glacial maximum 18,000 B.P.

44739 (CONF-850840—12) Preparation of backthinned ceramic specimens. Fisher, A.T.; Angelini, P. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016588.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

Backthinned specimens of ion-implanted single-crystal Al_2O_3 have been prepared by first protecting the implanted surface with NaCl. This protects against contamination of the back surface by impurities sputtered during the ion milling step in the backthinning process. The specimens can then be analyzed using analytical electron microscopy. (DLC)

44740 (DOE/ER/05016—T1) Separation of selected cations by liquid membranes. Progress report, 1 December 1982-31 July 1985. Christensen, J.J.; Izatt, R.M. (Brigham Young Univ., Provo, UT (USA)). 31 Jul 1985. Contract AC02-78ER05016. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016821.

The objective of our research program is to elucidate the chemical principles which are responsible for the cation selectivity and permeability of liquid membranes containing macrocyclic carriers. During the past three years, the research program has focused on three specific areas: investigation of cation transport in liquid surfactant (emulsion) membrane systems and in lipid vesicles which can be considered as models of such transport; selective cation transport from multiple cation mixtures; and transport of metal cations by proton-ionizable carriers. In the first area, both the macrocyclic carrier in the membrane phase and an irreversible cation complexing agent in the receiving phase have been found to be necessary for effective transport in both membrane systems. In the second area, work was completed to determine the cation permeabilities of membranes when two to four cations are present simultaneously. The results were compared to the equilibrium model of transport developed earlier. It was found that the equilibrium model correctly describes the data in those cases where cations of the same charge are mixed in the source phase, but that the correspondence between model and experimental results is not always good in the case of mixed electrolytes. This result has been rationalized in terms of the large difference in partition coefficient between cations of different charge as compared to those of identical charge. In the third area, new substituted calixarenes and new 4-hydroxy-pyridone macrocycles were synthesized and the transport of alkali metal cations by these carriers was investigated. The calixarenes were found to be selective for Cs^+, with calix[4]arene providing the greatest Cs^+ selectivity. On the other hand, the pyridone macrocyclic carrier was found to be selective for K^+. The transport mechanism for both carriers involves coupled M^+-H^+ transport in the membrane system. 18 refs., 1 fig.

44741 (DOE/ID/12430—T1) Oxygen enrichment of air using semipermeable membranes in a magnetic field. Final report, January 15, 1983-January 14, 1985. (Connecticut Univ., Storrs (USA). Dept. of Chemical Engineering). 1985. Contract FC07-83ID12430. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017032.

The use of semipermeable membranes to enrich oxygen from air has recently drawn a great deal of interest, particularly for combustion and medical applications. The maximum possible oxygen enrichment of air using silicone membranes is approximately 50%. By applying a nonuniform magnetic field to the membrane system, the paramagnetic properties of oxygen in theory may be used to achieve increased enrichment. Four magnetic test cells were developed to induce nonuniformity in a magnetic field of 15 Kilogauss. Three membranes were evaluated on these test cells: dimethyl silicone, dimethyl silicone/polycarbonate copolymer (MEM-213), and cellulose acetate. The evaluation consisted of determining the

oxygen flux at various pressure differences across the membrane. The tests were run at room temperature and pressure, both in and out of the magnetic field. The 15 Kilogauss magnetic field currently available to us produced negligible increases in the oxygen concentration with all pole pieces. A mathematical model was developed which showed that fields of 200-400 Kilogauss are needed to get enrichments of 0.5% and to overcome the reverse polarization (concentration diffusion) of oxygen built up next to the membrane. Fluxes in this range have been experimentally achieved but are not currently commercially available. This additional oxygen would cost 800 times more than currently available pure oxygen.

44742 **(INFO—0119) Automated methods for thorium determination in liquids, solids and aerosols.** Robertson, R.; Stuart, J.E. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 31 Mar 1984. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701939.

Methodology for determining trace thorium levels in a variety of sample types for compliance purposes was developed. Thorium in filtered water samples is concentrated by ferric hydroxide coprecipitation. Aerosols on glass-fibre, cellulose ester or teflon filters are acid digested and thorium is concentrated by lanthanum fluoride co-precipitation. Chemical separation and measurement are then done on a Technicon AAII-C auto-analyzer via TTA-solvent extraction and colorimetry using the thorium-arsenazo III colour complex. Solid samples are acid digested and thorium is concentrated and separated using lanthanum fluoride co-precipitation followed by anion-exchange chromatography. Measurement is then carried out on the autoanalyzer by direct development of the thorium-arsenazo III colour complex. Chemical yields are determined through the addition of thorium-234 tracer with assay by gamma-ray spectrometry. The sensitivities of the methods for liquids, aerosols and solids are approximately 1μg/L,0.5μg and 0.5 μg/g respectively. At thorium levels about ten times the detection limits, accuracy and reproducibility are typically +-10 percent for liquids and aerosols and +-15 percent for solid samples.

44743 **(INIS-mf—9337) Description of the equilibrium conditions of chemical reactions in various solvents. Microcalorimetric and radiochemical studies into the complexing of monovalent metal salts by macrocyclic polyethers.** Roehl, H. (Hamburg Univ. (Germany, F.R.). Fachbereich Chemie). 14 Jul 1983. 348p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85781551.

Empirical knowledge is taken as the basis for establishing a method to predict the equilibrium conditions of reactions of macrocyclic polyethers and monovalent metal cations in various solvents. The reactions in the solvents under review can be well described by the donor number DN according to Gutmann, and by the parameters alpha and pi-asterisk for the H bonding donor and polarity/polarisability, respectively, using a three-parameter equation according to Kamlet/Taft. This applies to both protic and aprotic solvents. The calculations rely on data found in the literature and on own experimental results obtained by microcalorimetric examinations. The evaluation methods evolved for this purpose also allow, by means of additional dilution experiments, to convert the "integral", microcalorimetrically obtained complex stability constants, (i.e. those non-discriminating between different types of state such as ions or ion pairs) to the corresponding "differentiating" constants (referring to purely ionic quantities), and this applied to the various solvents used. The method does not use foreign ions and can thus also be applied to those cases for which the normal standardisation of reaction conditions published in the literature cannot be maintained (e.g. for reasons of solubility). In some cases it was possible to obtain additional information on the dissociation behaviour of the salts used, which revealed differently strong inclination to form higher aggregations in solution, as shown e.g. by the strong concentration dependence of the salt ion pair dissociation constants obtained.

44744 **(INIS-mf—9700) Moessbauer methods and spectrometers specialized in qualitative and quantitative determinations.** Bibicu, I. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1981. 25p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701857.

Summary of a doctorate thesis.

A portable, field analyser devoted to fast qualitative and quantitative determination of cassiterite, which is the only tin compound of economic use in industry was made. This analyser differs from other similar ones described in the literature through the fact that pulses are cumulated only as long as the vibrator speed ensures a complete cancelation of the resonance condition. A NIM analyser was also manufactured which allows a qualitative determination of 2-3 iron compounds in a given sample, as well as of the total iron content. Working in geometry transmission and constant velocity regime, this analyser joins the inconstancy of a laboratory Moessbauer spectrometer with the swiftness and simplity of a specialized Moessbauer spectrometer. Analysis of the main factor that affects the qualitative and quantitative cassiterite determinations: sample structural composition, spectrometer calibrating, a.s.o. Determination accuracy is similar to those reported in the literature. Sample structural composition must be smaller than 0.1 mm for the qualitative and quantitative determinations of iron or total iron compounds. Data accuracy is similar to those reported before, but obtained by means of area measurements. As a consequence of the previous results, we have looked for the existence of some new phases in industrial Fe-C and Fe-Si steels or some new compounds appearance in the samples subjected to corroding.

44745 (INIS-mf—9740, pp 56) **Two dimensional correlation NMR spectroscopy in rotating samples.** Vega, S. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44746 **(IPEN-Pub—60) Spectrographic analysis of stainless steels.** Sabato, S.F.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1984. 23p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701940.

Two spectrogaphyic solution techniques, 'Porous Cup' and 'Vacuum Cup', were investigated in order to determine the minor constituents (Cr, Ni, Mo, Mn, Cu and V) of stainless steels. Iron and cobalt were experimented as internal standards. The precision varied from 4 to 11% for both spectrographic techniques, in which cobalt was used as international standard. Certified standards from National Bureau of Standards and Instituto de Pesquisas Tecnologicas were analysed to verify the accuracy of both techniques. The best accuracy was obtained with the Vacuum Cup techniques.

44747 **(IPEN-Pub—61) Spectrographic determination of dysprosium in doped crystals of calcium sulfate used for dosimetric material.** Grigoletto, T.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1984. 23p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85781552.

A spectrographic method is described for the quantitative determination of dysprosium in doped crystals of calcium sulphate. The consequences of the changes in some parameters of the excitation conditions, such as arc current, electrode type and total or partial burning of sample, in the analytical results are discussed. Matrix effects are investigated. Variations in the intensity of the spectral lines are verified by recording the spectrum in distinct photographic plates. The role of internal standard in analytical reproducibility and in counterbalance of the variations in the arc current and in the weight of sample is studied. Accuracy is estimated by comparative analysis of two calcium sulphate samples by X-Ray Fluorescence, Neutron Activation and Inductive Coupled Plasma Emission Spectroscopy.

44748 **(KFK—3830) Analytic of elements for the determination of soil->plant transfer factors.** Liese, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Feb 1985. 47p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751908.

This article describes a part of the conventional analytical work, which was done to determine soil to plant transfer factors.

The analytical methods, the experiments to find out the best way of sample digestion and the resulting analytical procedures are described. Analytical methods are graphite furnace atomic absorption spectrometry (GFAAS) and inductively coupled plasma atomic emission spectrometry (ICP-AES). In case of ICP-AES the necessity of right background correction and correction of the spectral interferences is shown. The reliability of the analytical procedure is demonstrated by measuring different kinds of standard reference materials and by comparison of AAS and AES.

44749 **(KFK—3909) Matrix correction for PIXE in biomedical samples.** Heck, D.; Rokita, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Mar 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752098.

FORTRAN.

This report describes the programs MATRIX2, STPPWRF2 and MUROFIT, which are used for the calculation of the matrix correction factors, which must be applied to concentrations determined by PIXE (Proton induced X-ray emission). The correction takes into account the slowing down of the protons along their path through the specimen, which causes a decreasing X-ray production along this path. Moreover these X-rays are attenuated penetrating the specimen towards to the X-ray detector. The matrix correction factors regard these effects in dependence on the proton impact energy, the specimen and detector geometry, the specimen composition and the energies of the interesting X-rays.

44750 **(LA-UR—85-2330) Coherent anti-Stokes Raman scattering in benzene and nitromethane shock-compressed to 10 GPa.** Schmidt, S.C.; Moore, D.S.; Shaner, J.W.; Shampine, D.L.; Holt, W.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-850759—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015682.

From 10. high pressure conference on research in high pressure science and technology; Amsterdam, Netherlands (8 Jul 1985).

The frequency shifts of the ring-stretching mode of shock-compressed liquid benzene and the CN stretching mode of nitromethane have been measured using coherent anti-Stokes Raman scattering. Shock pressures up to 11 GPa were achieved using a two-stage light gas gun. The frequency shifted Raman signal was generated using single pulse Nd:YAG and broadband-type lasers. 16 refs., 3 figs.

44751 **(MLM—3274) In-line x-ray fluorescence analysis of special nuclear materials in dissolver solution: materials development, laboratory simulation and parameterization.** Hudgens, C.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 5p. (CONF-850765—26). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016447.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

An automated x-ray fluorescence (XRF) analysis apparatus and sampling system have been used for a proof-of-principle test of on-line x-ray fluorescence assay of special nuclear materials (SNM) in dissolver solutions. A "total sampling" technique gives total mass assays with no need for solution density or tank volume measurements. Error propagation equations control the accumulation of high-precision data, and are also used for calculating parameters of x-ray fluorescence analysis equipment that will meet specified requirements. Short dwell times at each spectrometer setting significantly compensate for long-term instrumental drift. Sample cells that have survived prolonged exposure to dissolver solution are described. 7 refs., 2 tabs.

44752 **(PB—85-182426/XAB) Automatic sample changer for gamma spectrometry. Technical report.** Andrews, D.J. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research). [1985]. 15p. NTIS, PC E03/MF E03.

Monitoring of the environment for radioactivity, especially of artificial origin, is an important aspect of the role of the Directorate of Fisheries Research of the Ministry of Agriculture, Fisheries and Food (MAFF) at Lowestoft in meeting statutory responsibilities for the control of radioactive waste discharges to the aquatic environment. This requires the collection and radiometric analysis of a large number of environmental samples. The automatic sample changer described here is suitable for use with most existing gamma spectrometry systems which utilize germanium lithium (GeLi) or sodium iodide (NaI) detectors in vertical mode, in conjunction with a pulse-height analyser having auto-cycle and suitable data output facilities; it is linked to a Nuclear Data ND 6620 computer-based analysis system. It is designed for large-volume, low-activity environmental samples of various sizes up to maximum dimensions 100 mm diameter x 60 mm high.

44753 **(PB—85-189595/XAB) Data/evaluation for operator-inspector differences for a specific NDA instrument.** Franklin, M. (Commission of the European Communities, Luxembourg). [1985]. 69p. (EUR—9230-EN). NTIS, PC E04/MF E04.

The Joint Research Center (JRC) of the European Commission is developing a number of NDA instruments for safeguards use. One such instrument, a photoneutron-active interrogation device (Phonid) has been developed for the assay of U-235 in bulk quantities. This report describes new statistical results for the D statistic in the context of data evaluation algorithms for the Phonid instrument. The Phonid instrument is useful for this purpose because its error propagation structure is well characterized and yet not trivially simple. The data evaluation for Phonid data is derived from its error propagation modelling plus new results for the sampling distribution of the D statistic.

44754 **(PB—85-199826/XAB) STOAV84, computer program for an automatic gamma spectrometer for activation analysis. Research report.** Rosenberg, R.; Vaenskae, L. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [1985]. 38p. NTIS, PC E04/MF E01.

A computer program for the control of an automatic gamma spectrometer for activation analysis, STOAV84, is described. The program controls the sample changer, the multichannel analyzer, and the input-output devices. It also analyzes the gamma spectra and performs all the calculations needed in activation analysis. Irradiated samples are loaded into the sample changer after which the system measures the gamma spectra of the samples, analyzes them, and calculates the elemental concentrations.

44755 **(PB—85-206068/XAB) NBSGSC - a FORTRAN program for quantitative x-ray fluorescence analysis. Technical note (final).** Tao, G.Y.; Pella, P.A.; Rousseau, R.M. (National Bureau of Standards, Washington, DC (USA)). Apr 1985. 124p. (NBS/TN—1213). NTIS, PC A06/MF A01.

Also available from Supt. of Docs as SN003-003-02653-1. Prepared in cooperation with Geological Survey of Canada, Ottawa (Ontario).

A FORTRAN program (NBSGSC) was developed for performing quantitative analysis of bulk specimens by x-ray fluorescence spectrometry. This program corrects for x-ray absorption/enhancement phenomena using the comprehensive alpha coefficient algorithm proposed by Lachance (COLA). NBSGSC is a revision of the program ALPHA and CARECAL originally developed by R.M. Rousseau of the Geological Survey of Canada. Part one of the program (CALCO) performs the calculation of theoretical alpha coefficients, and part two (CALCOMP) computes the composition of the analyte specimens. The analysis of alloys, pressed minerals, and fused specimens can currently be treated by the program. In addition to using measured x-ray tube spectral distributions, spectra from seven commonly used x-ray tube targets could also be calculated with an NBS algorithm included in the program. NBSGSC is written in FORTRAN IV for a Digital Equipment Corporation (DEC PDP-11/23) minicomputer using RLO2 firm disks and an RSX 11M operating system.

44756 **(PNL-SA—13013S) Analysis of semi-volatile organic compounds using supercritical fluid methodologies.** Wright, B.W.; Chess, E.K.; Yonker, C.R.; Smith, R.D. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 7p. (CONF-850564—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016620.

From 5. annual national symposium on recent advances in the measurement of air pollutants; Raleigh, NC, USA (14 May 1985).

This study demonstrates the applicability of supercritical fluid chromatography (SFC) and analytical supercritical fluid extraction (SFE) for the analysis of semi-volatile compounds. Mixtures of nitro-polycyclic aromatic hydrocarbons that are not ammenable to gas chromatography were separated using SFC with tentative compound identifications made by SFC-MS. Comparisons of analytical SFE of XAD-2 resin and NBS Urban Dust (SRM 1649) to conventional Soxhlet extraction are also discussed.

44757 **Molecular spectrometry with a holographically scanned cw dye laser and supersonic cooling.** Whitten, W.B.; Ramsey, J.M. (Analytical Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Applied Spectroscopy;* 39: No. 4, 582-586(Jul 1985). Contract AC05-84OR21400.

The application of a high-resolution self-scanning cw dye laser to molecular spectrometry is explained. The laser uses optical feedback from a holographic pattern in a $BaTiO_3$ crystal to control its frequency and linewidth. Fluorescence excitation spectra of molecular iodine in a supersonic expansion have been measured, demonstrating the potential of the new technique.

44758 **Fourier transform infrared spectrometry using a very-long-pathlength cell: Dioxygen difluoride stability and reactions with plutonium compounds.** Kim, K.C.; Campbell, G.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Applied Spectroscopy;* 39: No. 4, 625-628(Jul 1985).

A unique spectroscopic device combining a Fourier transform infrared spectrometry instrument and a very-long-pathlength cell (a few hundred meters) is described. It shows much promise for spectroscopic studies of unstable or transient species at extremely low concentrations in a temperature-controlled environment. Results are presented of dioxygen difluoride (O_2F_2) fluorination reactions with Pu compounds and of O_2F_2 thermal stability measurements in the cell.

44759 **Comparative complexity of emission spectra from ICP, dc, Arc, and spark excitation sources.** Winge, R.K.; DeKalb, E.L.; Fassel, V.A. (Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Applied Spectroscopy;* 39: No. 4, 673-676(Jul 1985). Contract W-7405-ENG-82.

A comparison of atomic emission spectra excited in high voltage spark and dc are discharges and in an inductively coupled plasma revealed that the most complex spectra were emitted by the high voltage spark. The dc arc and the inductively coupled plasma yielded spectra of approximately equivalent complexity. These observations are not in accord with the impressions conveyed in the literature.

44760 **Contoured furnace tube for determination of volatile elements in ECP-emission spectrometry with electrothermal vaporization.** Matusiewicz, H.K.; Barnes, R.M. (Department of Chemistry, GRC Towers, University of Massachusetts, Amherst, Massachusetts 01003-0035). *Applied Spectroscopy;* 39: No. 4, 715-718(Jul 1985). Contract AC02-77EV04320.

The standard carbon furnace tubes were modified by contouring and reducing the wall thickness at the end. The furnace tube was tested in the inductively coupled plasma atomic emission spectrometer. It was found that the new design of the furnace tube eliminated multiple emission peaks. (AIP)

44761 **Salinity determination using NIRA.** Hirschfeld, T. (Lawrence Livermore National Laboratory, Livermore, Calfornia 94550). *Applied Spectroscopy;* 39: No. 4, 740-741(Jul 1985). Contract W-7405-ENG-48.

The determination of salinity of water by near infrared spectroscopic techniques is discussed. The concept of 'spectral shift reagents' is used and sufficiently rapid computer calculations yield the concentrations of Naci from measured absorbances at selected wavelengths. (AIP)

44762 **Separation of phenols from dilute aqueous solution by use of tri-n-octyl phosphine oxide as extractant.** MacGlashan, J.D.; Bixby, J.L.; King, C.J. (Univ. of California, Berkeley). *Solvent Extraction and Ion Exchange;* 3: No. 1-2, 1-25(1985). Contract AC03-76SF00098.

Trioctyl phosphine oxide (TOPO) is examined as an extractant for phenol and other phenolic compounds. Equilibrium distribution coefficients have been measured for extraction of phenol, dihydroxybenzenes, and trihydroxybenzenes by solvents composed of TOPO in various diluents. Results are interpreted in terms of a model based upon complexation stoichiometry, allowing for solvation of uncomplexed solute as well. TOPO is a strong complexant for all the phenolic solutes studied. The nature of the diluent has a significant effect upon distribution coefficients, and in the case of an alcohol diluent reduces the distribution coefficient for phenol considerably. The degree of complexation remains appreciable at temperatures which would be used for regeneration of phenol by distillation. This makes it necessary to use a diluent boiling at least 70°C to 80°C higher than the boiling point of phenol, which is 182°C. Regeneration studies are reported for isobutyl heptyl ketone, dimethylnaphthalene, and a mixture of dimethylnaphthlene and n-octadecane as diluents. Extraction with TOPO will be most worthy of consideration for feed concentrations of phenol equal to 3000 ppM or less, or for extraction of di- and tri-hydroxybenzenes.

44763 **Glycine enhanced separation of Co(II) and Ni(II) with bis(2,4,4-trimethylpentyl)phosphinic acid [Cyanex 272] by liquid-liquid extraction and supported liquid membranes.** Reichley-Yinger, L.; Danesi, P.R. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 3: No. 1-2, 49-60(1985). Contract W-31-109-ENG-38.

The extraction behavior of Co and Ni ions from aqueous nitrate solution containing glycine, and their separation by liquid-liquid extraction and supported liquid membranes (SLMs) has been studied. The separation factor between the two metals is greatly enhanced by the presence of glycine. The enhancement is due to the preferential complexation of the Ni ions by glycine. The conditional equilibrium constants of the extraction reactions and the SLM permeability coefficients have been measured. The results indicate that metal glycinate complexes are not extracted and that in presence of glycine very clean Co-Ni separation can be obtained in a single SLM pass.

44764 **TRUEX process - a process for the extraction of the transuranic elements from nitric acid wastes utilizing modified PUREX solvent.** Horwitz, E.P.; Kalina, D.G.; Diamond, H.; Vandegrift, G.F.; Schulz, W.W. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 3: No. 1-2, 75-109(1985). Contract W-31-109-ENG-38.

A generic transuranic (TRU) element extraction/recovery process was developed based on the use of octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide, O phi D(iB)CMPO, dissolved in PUREX process solvent (tributyl phosphate, TBP, in normal paraffinic hydrocarbon, NPH). The process (called TRUEX) is capable of reducing the TRU concentration by many orders of magnitude in waste solutions containing a wide range of nitric acid, salt, and fission product concentrations. A major feature of the process is that it is readily adaptable for waste processing in existing fuel reprocessing facilities.

44765 **Separation of actinides and lanthanides from acidic nuclear wastes by supported liquid membranes.** Danesi, P.R.; Chiarizia, R.; Rickert, P.; Horwitz, E.P. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 3: No. 1-2, 111-147(1985). Contract W-31-109-ENG-38.

Supported liquid membranes, SLM, consisting of a solution of 0.25 M octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide (CMPO) and 0.75 M tributylphosphate (TBP) in decalin absorbed on thin microporous polypropylene supports, have been studied for their ability to perform selective separations and concentrations of actinide and lanthanide ions from synthetic acidic nuclear wastes. The permeability coefficients of selected actinides (Am, Pu, U, Np) and of some of the other major components of the wastes have been measured using SLMs in flat-sheet and hollow-fiber configurations. The results have shown that with the thin (25

μm) flat-sheet SLMs, using Celgard 2500 as support, the membrane permeation process is mainly controlled by the rate of diffusion through the aqueous boundary layers. With the thicker (430 μm) hollow-fiber SLMs, using Accurel hollow-fibers as support, the membrane permeation process is controlled by the rate of diffusion through both the SLM and the aqueous boundary layers. Hollow-fibers SLMs exhibited lower permeability coefficients and longer life-times. The experiments have shown that the actinides can be very efficiently removed from the synthetic waste solutions to the point that the resulting solution could be considered a non-transuranic waste (less than 100 mCi/g of disposed form). The work has demonstrated that actinide removal from synthetic waste solutions is a feasible chemical process at the laboratory scale level.

44766 **Precautionary note on the use of dibutyl-N,N-diethylcarbamoylphosphonate in solvent extraction.** Kalina, D.G.; Tansey, B. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 3: No. 1-2, 173-179(1985). Contract W-31-109-ENG-38.

Investigation of dibutyl-N,N-diethylcarbamoylphosphonate (DBDECP) as a solvent extraction reagent has revealed that the commercially available compound apparently contains low concentrations of aqueous soluble impurities which drastically effect the distribution ratios obtained using tracer scale radiochemical techniques. Analysis of previously published data regarding this extractant indicates that wide variations exist in some of the reported distribution ratios obtained for this compound under quite similar conditions. Caution must be exercised, therefore, in interpreting solvent extraction data obtained with DBDECP.

44767 **Uranium alpha spectroscopy and angular dependence for SSNTD.** Espinosa, G.; Gamboa, I.; Jacobson, I.; Golzarri, J.I. (Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Fisica); Tommasino, L. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy)); Griffith, R. (Lawrence Livermore National Lab., CA (USA)). *Nuclear Tracks;* 8: No. 1-4, 433-435(1984). (CONF-830969—).

From 12. international conference on solid state nuclear track detectors; Acapulco, Mexico (4 Sep 1983).

During determination of uranium by the SSNTD method, we have found a clear relation between alpha energy and track diameters. It is possible to identify three characteristic track size peaks. We can also identify an angular dependence of track density when exposed in an aqueous medium. In this work, the experimental results are presented. They were obtained from alpha spectrometry using CR-39 as a detector, in aqueous uranium. We also present the results of the angular dependence measurements.

44768 **Intracellular dye heterogeneity determined by fluorescence lifetimes.** Packard, B.S.; Karukstis, K.K.; Klein, M.P. (Lawrence Berkeley Lab., CA). *Biochimica et Biophysica Acta;* 769: 201-208(1984). Contract AC03-76SF00098.

The cellular localization of a fluorescent probe molecule depends on both the chemical structure of the dye and the cellular environment. To study the number and types of environments in an epithelial cell line, the fluorescence lifetimes of three structurally distinct fluorescent dyes - rhodamine-B, 3,3'-dihexadecylindocarbocyanine-(C_{16}) (diI), and Collarein - incorporated into Madin-Darby canine kidney (MDCK) cells have been measured. The latter is a rhodamine-cardiolipin conjugate that was designed and synthesized for the property of exclusive localization in the plasma membrane. The former two dyes required at least two exponential components to fit their fluorescence decay curves, while the decay of Collarein was characterized by a single exponential. These data are consistent with fluorescence microscopic observations, in which diI and rhodamine-B exhibit heterogeneous spatial distributions, while Collarein appears to be located on the cell surface.

44769 **Laser excited atomic fluorescence spectrometry as a tool for chemical analysis.** Goff, D.A. Ames, IA; Iowa State Univ. (1981). 140p. University Microfilms Order No. 82-09,122.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Laser excitation of atomic fluorescence overcomes several problems encountered when doing trace elemental analysis by atomic fluorescence spectrometry (AFS). One major problem encountered in AFS is light scattering, which may ultimately determine the minimum detectable atomic concentration. An atomic fluorescence spectrometer based on a wavelength-modulated continuous-wave dye laser is shown to diminish the light scattering signal and extend the minimum detectable concentration well beyond that obtained by using a mechanical chopper for the determination of Ba in a premixed flame. A pulsed frequency-doubled dye laser was used to investigate the potential of the inductively coupled plasma (ICP) as an atomic reservoir for AFS. The laser was used to obtain spatial profiles of the AFS signal from iron in the extended tail plume of an ICP. The limit of detection for iron in the ICP is comparable to that obtained in a conventional flame, but the ICP offers the significant advantage of relative freedom from matrix problems. The excitation of atomic fluorescence by lasers that are not in resonance with the atomic transition is also studied for the cases of sodium and nickel. This off-resonant excitation opens the possibility of multielement analysis by laser excited atomic fluorescence spectrometry.

44770 **(RFP-Trans—450) Quantitative analysis of oxygen in arsenic trichloride by fast neutron activation.** Ishikawa, Hiroshi; Ishii, Eiichi; Nakane, Masanori; Miyake, Yoshizo. Translated from *Bunseki Kagaku ;* 20: 1370-1374(1971). Contract AC04-76DP03533. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013556.

Oxygen in arsenic trichloride was quantitatively analyzed by fast neutron activation. Samples of arsenic trichloride were enclosed in polyethylene capsules and irradiated. Reference standards were prepared by mixing glucose and carbon powder of spectrometric quality and compression-molding the mixture until the apparent density was identical with that of arsenic trichloride. Thus it was not necessary to calibrate for the self-absorption effect of neutrons and analysis radiation. The irradiation intensity and the measurements were standardized by an automatic device. The coefficient of variation in the range of 1 to 60 mg oxygen was 6 to 12%, and the determination limit was 60 ppM. This technique was used for quantitative analysis of total oxygen concentrations in arsenic trichloride which had been dispersed in water and in hydrochloric acid and arsenic trichloride samples which had undergone various dehydration treatments. The results were compared with the results of quantitative analysis of the water content by the tritium tracer method. 7 refs., 6 figs., 1 tab.

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REFER ALSO TO CITATION(S) 44692, 44709, 44744, 44745, 44770, 44819

44771 **(CONF-850786—1) Recent developments in the structural crystallography of boron and the higher borides.** Yakel, H.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016930.

From International conference on the physics and chemistry of boron and boron-rich borides; Albuquerque, NM, USA (29 Jul 1985).

This paper reviews structural studies of boron and boron-rich borides over the last decade using as a framework the classification scheme proposed by Matkovich and Economy. Chemical bonding in boron polyhedral units and the packing of these units in normal 3D space lattices are described with emphasis on stabilization effects that may be produced by "impurity" elements. Potentially useful areas for structural work with several new scattering and spectroscopic techniques are suggested. The paper concludes with a discussion of possible connections between boride crystal chemistry and the developing subject of quasicrystalline structure. 67 refs.

44772 **(DOE/ER/05399—8) Theoretical studies of electron and proton transfer processes in fluids. Progress report, August 1984-August 1985.** Kestner, N.R. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry). 1985. Contract AS05-77ER05399. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016899.

Research accomplished during this grant period involved studies of negative water clusters, water-water interactions, interac-

tion of hexa-aquo iron complexes using water water interactions, proton transfer, and electron transfer rates.

44773 (DOE/ER/10756—4) Energy partitioning in elementary gas phase reactions. Progress report, April 1, 1983-August 31, 1985. (Columbia Univ., New York (USA). Dept. of Chemistry). 1985. Contract AC02-80ER10756. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016265.

This research is mainly devoted to state to state studies of reactions of the form A + BC = AB + C, AB + CD = ABC + D and A + BCD = AB + CD in which A,B,C,D are atoms. Some of the work has been development of new techniques for the determination of state distributions. The reactions must inevitably be fast reactions or else there is no possibility of studying nonequilibrium state distributions. In essence the time constant for the reaction must be shorter than the time constant for relaxation of the degree of freedom whose state distribution is being measured. The atoms A are generated all at once (within 15 ns) by laser photodissociation of a parent molecule and the product atoms or molecules are probed by a second laser, a dye laser. At first sight the necessity that the reaction be fast would seem to rule out the study of endothermic reactions or reactions with substantial activation energy. A solution is to provide the reactants with sufficient energy so that the slow reaction becomes fast. This is done by using photodissociated atoms which are prepared in an excited electronic state ($O(^1D)$, $S(^1D)$, $C(^1D)$) or have large kinetic energy (H atoms, OH radicals). 13 refs.

44774 (DPST—85-217) Glass/metal interactions, leaching, waste glass, canister material. Burns, D.B.; Upton, B.H.; Wicks, G.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 7 Jan 1985. Contract AC09-76SR00001. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015825.

A series of glass/metal leaching experiments have been conducted to evaluate the effects of potential metal canister and metal overpack materials on the durability of SRP waste glass. A modified leaching test, based upon standard MCC-1 leaching procedures, was used. The metals studied included: low carbon steel, ferritic steel, austenitic steel, a titanium based alloy, lead, Inconel 600, and E-Brite. The simulated SRP waste glass system studied was 131/TDS waste glass, a glass system with the most extensive data base available. At the conclusion of the test, leachate samples were analyzed for key elements in solution, and the surfaces of the metal and glass samples were examined for microstructural changes. 15 figs., 4 tabs.

44775 (IFP—32-225) Three phase fluidized bed reactors: hydrodynamic characteristics and mixing of particles. Fortin, Y. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). Jul 1984. 246p. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number DE85752373.

The hydrodynamic characteristics, i.e. fluidization minimum velocity, retentions of the various phases, and expansion rates, of a large three phase fluidized bed are determined. The variable parameters are the standing-by bed height, the superficial velocity of fluids, and the solid particle characteristics (density, dimension and shape). The fluids utilized are cyclohexane and nitrogen and the particles are industrial catalyst holders such as balls and alumina extrudates. This study is based on an electromagnetic measuring method of particle concentration which are traced at various levels in the column.

44776 (INIS-mf—9740, pp 55) Deuteration effects in the multiphonon relaxation of crystals. Englman, R. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Siebrand, W. (National Research Council of Canada, Ottawa, Ontario. Div. of Chemistry). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44777 (INIS-mf—9740) 50. Anniversary meeting. Program and abstracts. (Israel Chemical Society, Tel-Aviv). 1984. 230p. (CONF-8404250—Absts.). NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539.

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

Indexing for selected summaries are included in the Energy Data Base.

44778 (IS-M—547) New examples of clusters, extended metal-metal bonding and interstitial derivatives. Corbett, J.D. (Iowa State Univ. of Science and Technology, Ames (USA)). 1985. Contract W-7405-ENG-82. 4p. (CONF-8504163—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015522.

From 8. international conference on solid compounds of the transition elements; Vienna, Austria (7 Apr 1985).

Synthesis of many new compounds with unusual stoichiometries and with structures that exhibit strong metal-metal bonding has been achieved in the last 10 to 12 years in binary halides of the early transition metals. Such characteristics had previously been limited to metal octahedra in the wellknown (Nb,Ta)$_6$X$_{12}$/sup n+/ and (Mo,W)$_6$X$_8$/sub m+/ halide clusters (6-12 and 6-8 types, respectively; X= Cl, Br, I). This new chemistry is found for highly reduced binary halides of the metals Sc, Y, La, Zr, Hf and some lanthanides. The metal-metal arrays in these may be classified as conventional 6-12 or 6-8 type clusters that have, in response to reduced X:M ratios, condensed by sharing metal-metal edges to form infinite chains or sheets of clusters. The structures and properties thus lie along the interface between metals and normal salts. Some of the compounds have been found to bind a variety of small nonmetals within the metal interstices while others are uniquely stabilized by such interstitial atoms. Structure and bonding correlations as well as valence photoelectron spectra and extended Hueckel calculations will also be considered. 3 refs., 6 figs.

44779 (JAERI-M—84-059) Effects of pressure on the first-order phase transition of Cu_4SnS_4 and Cu_8GeS_6. Anzai, Shuichiro; Ozawa, Kunio. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701859.

Cu_4SnS_4 and Cu_8GeS_6 undergo the first-order transitions at T sub(S) and T sub(G), respectively. The transitions have the characteristics of the less conductive (below T sub(S) and above T sub(G)) to well conductive (above T sub(S) and below T sub(G))states. These transition temperatures, measured at hydrostatic pressures P up to 8 kbar, are expressed as follows: T sub(S)(P) = (232.5 +- 0.5) - (9.5 +- 0.1) x P K and T sub(G)(P) = (334.6 +- 0.2) + (2.91 +- 0.05) x P K. The latent heats of the transitions at P = 0 are 1.3 kJ/mol for Cu_8SnS_6 and 6.9 kJ/mol for Cu_8GeS_6. The magnetic susceptibilities at P = 0 show no anomalous changes at T sub(S) and T sub(G) and their diamagnetic values are in agreement with the sums of the ion-core susceptibilities of Cu^+, S^{2-} and Sn^{4+} or Ge^{4+}. A Gibbs free energy is proposed on the system in which the distortion of the lattice frame and the thermal dissociation of current-carrier ions from the lattice frame are coupled. A simulation, based on the free energy expression, indicates a possibility that the lattice distortion is co-operative with the carrier ions in the interstitial sites in Cu_8GeS_6, while it is repulsive in Cu_4SnS_4.

44780 (JAERI-M—84-060) Diffusion phenomena of fluorine and cations in molten Li_2BeF_4, $LiBeF_3$ and $NaBeF_3$. Ohno, Hideo. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701860.

Self-diffusion coefficients of fluorine and cations in molten LiF-BeF_2 and NaF-BeF_2 systems were summarized by the capillary reservoir technique. The diffusion coefficients and the activation energies of cations in these molten salts follow a similar behavior with those of cations in molten alkali halides. On the other hand, self-diffusion of fluorine have unusually high diffusion coefficients and activation energies. The characteristic diffusion phenomena of fluorine in these molten alkali fluoroberyllates are very similar to those of oxygen in molten CaO-SiO_2 and CaO-SiO_2-Al_2O_3 slag. The dynamical behavior of Li and F in molten Li_2BeF_4 was also ana-

lyzed by NMR technique. According to both these experiments, most probable mechanism of characteristic diffusion of fluorine in these molten systems could be dissociation of F atom from complex anion and long distance diffusion.

44781 **(K/PS—5048) Manufacture of high purity metal fluorides.** Vance, J.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1984. Contract AC05-84OT21400. 15p. (CONF-8411141—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016250.

From Workshop on tungsten for VLSI applications; Albuquerque, NM, USA (12 Nov 1984).

The Oak Ridge Gaseous Diffusion Plant has been developing technologies of many kinds since the early forties. The primary purpose of this R and D was to reduce the amount of electrical power and capital expense associated with the enrichment of uranium in the 235 isotope. One area that has received a lot of attention is the chemistry of fluorine and metal fluorides. The producing facility at ORGDP is a chemical pilot plant which has been used through the years to demonstrate new processes. Presently existing in this facility are: absorption columns which have been used to remove trace quantities of krypton and oxides of nitrogen and sulfur from gas streams; a flame reactor that is being used to reduce isotopically altered sulfur hexafluoride for conversion to SO_2 which will be used in acid rain studies; an environmental hold system in which methods were developed to remove or neutralize environmental insulting compounds; a fluid bed reactor, and of course the tungsten hexafluoride process. A rhenium hexafluoride facility is also located in the pilot plant. It is basically the same as the tungsten line with three small muffles being used in place of the large WF6 reactor. The product from each process is heated and transferred to approved 5-inch shipping cylinders and transported to the analytical chemistry laboratory for sampling and analysis. These cylinders must be used for shipment and may require modification of the customer facility to accommodate them. Liquid samples are obtained from the product cylinders and a visual examination of the samples for color and melting temperature provides a good indication of the conversion. X-ray fluorescence is utilized to determine the amount of tungsten and the percent conversion to the hexafluoride is calculated from the weighed sample. Infrared in addition to mass spectrometer analyses are performed to verify the findings. The material is then analyzed by spectrographic methods for contaminants.

44782 **(MLM—3273(OP)) Noble gas-carbon dioxide thermal diffusion factors: anomalous behavior for Ar/CO_2.** Taylor, W.L.; Pickett, P.T. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Cincinnati Univ., OH (USA). Dept. of Chemistry). 1985. Contract AC04-76DP00053. 20p. (CONF-850617—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016449.

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

Thermal diffusion factors α/sub Tau/ for equimolar mixtures of neon and argon with carbon dioxide have been measured in the temperature range from 250 to 700K. The data were obtained in a 20-tube trennschaukel, or "swing separator". The Ne/CO_2 system demonstrated the expected increase in α/sub Tau/ with increasing temperature as predicted by the Chapman-Enskog theory using spherically symmetrical interaction potentials and elastic collisions. The thermal diffusion factor for Ar/CO_2, however, demonstrated an inverse temperature effect which is not fully understood. While this effect has been observed by other workers, the present data exhibit a less precipitous decrease with temperature. Using interaction potentials available in the literature, it was possible to theoretically calculate accurate values of α/sub Tau/ for Ne/CO_2 but not for Ar/CO_2. 20 refs., 5 figs., 3 tabs.

44783 **(SAND—85-0920C) Photochemically volatilized polysilanes: a new class of self-developing deep uv resists.** Zeigler, J.M.; Harrah, L.A.; Johnson, A.W. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850942—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE85010655.

From 190. American Chemical Society national meeting; Chicago, IL, USA (8 Sep 1985).

A resist material which combines high short-wavelength sensitivity, "self-development" (i.e., generation of the resist image directly upon exposure), and resistance to dry-etching procedures is a major goal. While sensitive self-developing materials are known for use in the deep-uv, e.g., poly(olefin sulfones) reported by Bowden and coworkers and sensitized end-capped poly(phthalaldehyde), their resistance to plasma etchants is marginal. A number of groups have reported the direct deep-uv laser etching of a variety of organic polymeric materials, but exposures of >1 J/cm^2 are required for removal of a 1 μ thick film in these cases. In this paper, we describe a new class of alkyl polysilane copolymers which exhibit relatively efficient self-developing behavior and have excellent resistance to O_2 reactive ion etchants. Films of these new polysilanes 1 μ in thickness can be completely photochemically volatilized to give submicron feature resolution at total exposures of 500 to 1000 mJ/cm^2 of deep-uv from a KrF excimer laser (248 nm) or low-pressure Hg lamp (254 nm). 13 refs., 3 figs.

44784 **(SAND—85-1706C) Influence of shock compression on the specific surface area of inorganic powders.** Williams, F.L.; Morosin, B.; Graham, R.A. (New Mexico Univ., Albuquerque (USA). Dept. of Chemical and Nuclear Engineering; Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 11p. (CONF-850770—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016816.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

Four characteristic behaviors as a function of peak shock pressure have been observed for changes in the specific area of inorganic powders modified by shock wave loading. The mechanisms producing the observed responses appear to be abrupt phase change, communition of particles and interparticle bonding. Recently, classical BET surface area measurements were reported for compacts of aluminum oxide, zinc oxide, aluminum nitride, titanium carbide and titanium diboride after they were subjected to controlled shock-loading to mean peak pressures from 4 to 27 GPa. Extension to specific surface area measurements of shock loaded hematite, magnetite, manganese dioxide and well annealed alumina powders has been accomplished. Sampling from the edge, center and the bulk of shock-loaded compacts of these powders reveals variation in the degree of modification consistent with the calculated variation of the shock pressure and shock temperature. It was also found that the apparent response of a material to shock-loading can be masked if the starting material is already highly defected. The nature of morphological changes in powders is of interest in understanding shock activated sintering, shock enhanced catalytic activity, dynamic compaction and shodk-enhanced solid state reactivity. 8 refs., 5 tabs.

44785 **Reactions of iron clusters with hydrogen. III. Laser-induced desorption of H_2 by multiphoton absorption.** Liu, K.; Parks, E.K.; Richtsmeier, S.C.; Pobo, L.G.; Riley, S.J. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* 83: No. 6, 2882-2888(15 Sep 1985). Contract W-31-109-ENG-38.

Multiphoton absorption and ionization of hydrogenated (or deuterated) iron clusters generally leads to desorption of a specific number of H_2 (or D_2) molecules for a given cluster size and a given number of photons absorbed. Ionization via single photon absorption occurs without desorption. Experimental results demonstrate that the fragmentation pattern resulting from multiphoton absorption is independent of whether desorption precedes or follows ionization. From the number of desorbed molecules and the number and energy of absorbed photons an estimate of 1.3 eV for the desorption energy can be made without the necessity of modeling the desorption process. A simple statistical model of the process provides similar estimates of the desorption energies, and indicates that the energy has some dependence on cluster coverage.

44786 Raman spectroscopy of polymorphic orthophosphates containing sodium and lanthanide elements. Bamberger, C.E.; Busing, W.R.; Begun, G.M.; Haire, R.G.; Ellingboe, L.C. (Oak Ridge National Lab., TN). *Journal of Solid State Chemistry;* **57**: No. 2, 248-259(Apr 1985). Contract AC05-84OR21400.

Mixed orthophosphates (Na_3Ln/sub x/(PO_4)/sub y/) containing sodium and lanthanide elements have been prepared by several synthetic methods and have been characterized by Raman spectroscopy at both ambient and elevated temperatures, X-ray diffraction, and neutron activation analysis. The elements from La to Gd have been observed to form compounds with the stoichiometry $Na_3Ln(PO_4)_2$, which exhibit only one type of symmetry. Yttrium and the elements from Tb to Lu form compounds with the stoichiometries $Na_3Ln(PO_4)_2$ and $Na_3Ln_2(PO_4)_3$. Each compound occurs in several crystal symmetries. One of these, designated as phase γ, appears to be a new phase. 16 references, 5 figures, 4 tables.

44787 Hydrolysis of iodine: Equilibria at high temperatures. Palmer, D.A.; Ramette, R.W.; Mesmer, R.E. (Oak Ridge National Lab., TN (USA). Chemistry Div.). *Journal of Nuclear Materials;* **130**: 280-286(Feb 1985). (CONF-840807—). Contract AC05-84OR21400.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The hydrolysis (or disproportionation) of molecular iodine to form iodate and iodide ions has been studied by emf measurements over the temperature range, 3.8 to 209.0°C. The interpretation of these results required a knowledge of the formation constant for triiodide ion and the acid dissociation constant of iodic acid, both of which were measured as a function of temperature. The resulting thermodynamic data have been incorporated into a general computer model describing the hydrolysis equilibria of iodine as a function of initial concentration, pH and temperature.

44788 Lack of atomic silver stabilization by crown ether surfactants. Li, A.S.W.; Kevan, L. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). *Arabian Journal for Science and Engineering;* **9**: No. 1, 3-6(1984).

Electron spin resonance studies of silver ion reduction in Kryptofix 22-C14 crown ether micelles give no support for silver atom stabilization at either room temperature or 77 K. It is concluded that the reduced silver complex interacts with other silver species owing to the flat structure of the crown ether complex and the dynamic nature of micelles to form multinuclear silver species.

44789 Rotational predissociation of Ar-HD van der Waals complex: space-fixed complex-coordinate coupled-channel calculations. Datta, K.K.; Chu, S.I. (Univ. of Kansas, Lawrence). *Chemical Physics Letters;* **95**: No. 1, 38-45(18 Feb 1983). Contract AC02-80ER10748.

The space-fixed complex-coordinate coupled-channel (SFCCCC) method is applied to the accurate determination of the level energies and widths (lifetimes) of predissociating states of Ar - HD(Nu = 1, j = 2) van der Waals molecule, using the Carley - Le Roy $BC_8(6,8)$ potential for Ar - H_2. The calculated widths are in good harmony with the experimental data of McKellar and in excellent agreement with the close-coupling scattering results of Hutson and Le Roy.

44790 Thermal ionization of quaternary ammonium salts. Glish, G.L.; Smith, D.H. (Oak Ridge National Lab., TN). *International Journal of Mass Spectrometry and Ion Physics;* **50**: 143-149(1983). Contract W-7405-ENG-26.

Thermal ionization of quaternary ammonium salts is shown to be an efficient and soft ionization method at high ionization-filament temperatures. Evidence is also presented in support of previous postulates concerning the mechanisms of formation of fragment ions, and the combination of thermal ionization with mass spectrometry/mass spectrometry (MS/MS) is demonstrated.

44791 Structure of adeninium dinitrate, $C_5H_7N_5^{2+}$. $2NO_3^-$. Hardgrove, G.L. Jr.; Einstein, J.R.; Hingerty, B.E.; Wei, C.H. (St. Olaf College, Northfield, MN). *Acta Crystallographica, Section C: Crystal Structure Communications;* **C39**: 88-90(1983). (CONF-8203208—). Contract W-7405-ENG-26.

From American Crystallographic Association meeting; Washington, DC, USA (29 Mar 1982).

Crystals of adeninium dinitrate were prepared from a solution of adenine, cadmium nitrate, and nitric acid. The base rings are protonated in positions 1 and 7 with a characteristic increase in the C-N-C bond angle relative to unprotonated adenine. The dication forms five hydrogen bonds with nitrate ions nearly in the same plane. The hydrogen-bonded groups form staggered-chain ribbons extending in the b direction. Crystal parameters for the compound are reported.

44792 Synthesis and antitumor activity of 2-β-D-ribofuranosylselenazole-4-carboxamide and related derivatives. Srivastava, P.C.; Robins, R.K. (Oak Ridge National Lab., TN). *Journal of Medicinal Chemistry;* **26**: No. 3, 445-448(1983).

Treatment of 2,3,5-tri-O-benzoyl-β-D-ribofuranosyl-1-carbonitrile with hydrogen selenide provided 2,5-anhydro-3,4,6-tri-O-benzoyl-D-allonselenoamide (3). Compound 3 was treated with ethyl bromopyruvate to provide ethyl 2-(2,3,5-tri-O-benzoyl-D-ribofuranosyl)selenazole-4-carboxylates, which after ammonolysis were converted to 2-β-D-ribofuranosylselenazole-4-carboxamide (6) and its α-analogue 7, respectively. Acetylation of nucleoside 6 provided 2-(2,3,5-tri-O-acetyl-β-D-ribofuranosyl)selenazole-4-carboxamide, and phosphorylation of 6 provided the corresponding 5'-phosphate 9. Compounds 6 and 9 were found to be cytotoxic toward P388 and L1210 cells in culture and effective against Lewis lung carcinoma in mice.

44793 Silver(I) ion complexation by carbonate and oxlate at 25°C. Maya, L. (Oak Ridge National Lab., TN). *Journal of the Less-Common Metals;* **90**: 137-142(1983). Contract W-7405-ENG-26.

The complexation of silver(I) ions by carbonate and oxalate was measured by potentiometric means using a silver-ion-sensitive electrode. The conditional formation constants at 25°C and μ = 1.0 M with $NaClO_4$ as background electrolyte are log ($\beta^*(AgCO_3^-)$) $\leqq$ 1.5 and log ($\beta^*AgC^2O_4^-$)) $\leqq$ 0.9. Both complexes are rather weak. The relative contribution of the carbonate complexation of silver to speciation schemes of this ion in natural waters will be minor because of competing complexation and precipitation reactions with hydroxide and chloride ions.

44794 Upper limit for the methane-oxygen initiation reaction in the presence of iodine-131 behind reflected shock waves. Pardini, S.P. Ames, IA; Iowa State Univ. (1981). 113p. University Microfilms Order No. 82-09,156.Contract W-7405-ENG-82.

Thesis (Ph. D.).

A one-inch diameter single-pulse shock tube was used to study the rate of methyl iodide formation from 815 to 1151K via the reaction of CH_4 with I, and the observed rate constant is recorded. Tracer quantities of ^{131}I were used to follow the course of the reaction. At 1097K in a stoichiometric methane-oxygen reaction mixture with small amounts of iodine present, the methane-oxygen initiation reaction was not found to occur, thus putting an upper limit on the rate constant. Mass-spectral analysis of the reaction products from the latter experiment indicated that formaldehyde was formed; at 1097K oxygen was able to successfully compete with iodine for methyl radicals. The reaction of methyl radicals and molecular oxygen was noted, and the rate constant is recorded.

44795 (RFP-Trans—446) Study of the phase diagram of the calcium chloride/calcium system by DTA. Sanchez, J.A.; Monnier, R. Translated from *Revue des Hautes Temperatures et des Refractarires ;* **16**: 5-11(1979). Contract AC04-76DP03533. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014885.

The system calcium-chloride-calcium was investigated by a differential thermal analysis technique such that during the measurements equilibrium was always reached. The temperature and the composition of the eutectic; the temperature of the monotectic; and the salt-rich monotectic composition were determined with good precision. These results are compared with those obtained by other authors. Finally, a cryoscopic study was also carried out of the system rich in $CaCl_2$ in order to establish i (the van's Hoff number)

as a function of Ca concentration, for small concentrations of this metal. The structure of $CaCl_2$-Ca solutions that agrees best with the finding is proposed. 14 refs., 5 figs., 2 tabs.

44796 (UCRL-Trans—12055) Reaction of chlorine trifluoride with water. Bougon, R.; Carles, M.; Aubert, J. Translated from *Comptes Rendus des Seances de l'Academie des Sciences, Serie C: Sciences Chimiques ;* **265**: vp(17 Jul 1967). Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85012418.

The mechanisms of this reaction, which vary depending on the relative proportions of ClF_3 and H_2O, are presented: an initial molar ratio of $ClF_3/H_2O < 2/3$ leads to the compounds HF, Cl_2, O_2, while a ratio of $ClF_3/H_2O > 2/3$ yields HF, Cl_2, O_2, ClO_2F, ClF. The formation of small quantities of ClO_3F is interpreted by a reaction between O_2 and the ClO_2F formed. The mechanism of the explosion that occurs frequently during the violent reaction between ClF_3 and H_2O in the condensed phase is not considered. The nature and the formation mechanisms for the products after obtaining a relatively slow state of evolution with respect to our detection methods is investigated. 8 refs.

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REFER ALSO TO CITATION(S) 43625, 43652, 43718, 44745, 44756, 44772, 44788, 44791, 44793, 44834, 45053

44797 (DOE/ER/00854—43) Fundamental studies of separation processes. Technical progress report, 10 August 1984-16 July 1985. Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). 1985. Contract AS09-76ER00854. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016127.

Basic studies of solute-solvent and solute-surface interactions have been made using chromatographic retention behavior. In one study, the retention of a polyethyleneglycol was shown to be greatly decreased by the presence of sodium iodide as a result of a major conformational change. In two studies using isomeric trimers of polystyrene, polarity of either the solvent or the surface of the packing was shown to be dominant when the other phase was nonpolar. Finally, vanadium nonporphyrins from Venezuelan crude continue to be studied with the as yet unattained goal of obtaining fractions that consist of an individual compound. 3 refs.

44798 (DOE/ER/05563—1) Applications of functionalized polymers in catalysis. Progress report, September 1, 1977-June 1, 1978. Bergbreiter, D.E. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1 Jun 1978. Contract AS05-77ER05563. 7p. (ORO—5563-1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016602.

Research progress to date has mainly involved characterization and synthesis of suitably functionalized polymers for our studies in catalysis. Preliminary work has begun on applications of these functionalized polymers in catalysis. Specifically, we have added a nitroxyl spin-labeled polystyrene to the palladium catalyzed disproportionation of cyclohexene in refluxing cyclohexane. Some reduction of this insoluble spin label was observed qualitatively by esr. Further work now in progress will be needed to confirm this preliminary result and ascertain whether or not homogeneous intermediates are present. Polymer bound bis(cyclopentadienyl)titanium has also been prepared and successfully used to transform alkenes directly into Grignard reagents.

44799 (DOE/ER/10745—T2) [Charge separation in photoredox reactions]. Informal annual technical progress report, October 1, 1982-August 1, 1983. Kevan, L. (Houston Univ., TX (USA). Dept. of Chemistry). 1 Aug 1983. Contract AS05-80ER10745. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016846.

The general goal of this research is to better characterize and understand the structural aspects that optimize photoinduced charge separation in organized molecular assemblies. Pulsed and CW electron magnetic resonance methods are being primarily exploited for this purpose. A major tool is electron spin echo modulation spectrometry by which very weak electron-nuclear hyperfine interactions can be measured even in disordered systems and which in many ways allows unique information to be obtained about the surroundings of paramagnetic species in frozen solutions.

44800 (IFP—31-548) Studies of hydrogen transfer reactions from hydrocarbon transformation in catalytic cracking. Mercier des Rochettes, B. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). Nov 1983. 172p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750564.

Reactions of hydrogen transfer and isomerization which occur over industrial cracking catalysts have been examined using four types of hydrocarbons as reactants: two cyclo-olefines (cyclopentene, cyclohexene), two cyclo-diolefines (cyclopentadiene, methylcyclopentadiene), a naphtheno-aromatic (tetraline) and a linear olefin (n-hexene). This investigation used a novel microreactor equipped with a four-microvalve system for sampling the vapor stream effluent from the reactor. This apparatus enabled us to study the kinetic behavior of catalysts during their deactivation. Alkylcyclopentenes and alkylcyclopentadienes are essential intermediates in coke formation. Two kinds of complementary mechanisms involving either spirannic or Diels-Alder intermediates are proposed. As opposed to cyclohexene and cyclopentene (which give bicyclic aromatics as coke precursors, n-hexenes are converted into monoaromatics and light products by a Diels-Alder mechanism between linear dienes and dienaphiles followed by aromatization and dealkylation of the forming cycles. Kinetic constants of hydrogen transfer and of isomerization are determined at given on-stream times over diversely coked catalysts. The increase and decrease observed in kinetic characteristics (activation energy and factor frequency/versus on-stream times) are explained by a continual modification of the catalyst surface during feed injection. According to the coking degree of catalysts, two kinds of phenomena occur. The increase of these parameters versus on-stream times could be due to the greater increase of the coke precursor desorption rate in comparison to their formation rate when the reaction temperature rises. The opposite effect would explain the decrease in the kinetic characteristics. The activation energy of hydrogen transfer (from cyclopentene transformations) is equal to 50 Kj/mole. 95 references are given in the bibliography.

44801 (INIS-mf—9714, pp 14-15) **Adsorption, dissociation and desorption of medium-sized organic compounds.** Rendulic, K.D.; Winkler, A.; Steinrueck, H.P. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). Nov 1984. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781213.

Published in summary form only.

In Progress report 1983/1984 of the Solid State Institute of the Technical University of Graz.

44802 (INIS-mf—9740, pp 50) **Deuterium NMR of deuterated probes dissolved in stretched polyethylene.** Gottlieb, H.E.; Luz, Z. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44803 (IS-T—1206, pp 58-116) **Multi-resonant four wave mixing spectroscopy of pentacene in naphthalene.** Chang, T.C.; Johnson, C.K.; Small, G.J. Jul 1985. NTIS, PC A09/MF A01. File Number DE85015563.

In Fully resonant four wave mixing spectroscopy of pentacene and dye molecules in condensed phases.

Dispersive multi-resonant coherent anti-Stokes (CARS and CSRS) data are reported for pentacene in naphthalene. The vibronic resonances are associated with the lowest excited singlet state of pentacene. Attention is focused on the 755 cm^{-1} ground state fundamental of pentacene, its excited state counterpart at 747 cm^{-1} and their two partners which move with the detuning, d, of the ω_1 laser away from the electronic origin transition at $\omega_{0,0}$ ($d = \omega_1 - \omega_{0,0}$). Temperature dependent studies indicate that the excited state population mechanism involves phonon hotband absorption.

Power broadening data for the 755 cm^{-1} resonance obtained for negative detunings are discussed in terms of a distribution of dynamic Stark shifts resulting from the site inhomogeneous line broadening of vibronic transitions. CARS and CSRS data are presented which are consistent with line narrowing for the 755 cm^{-1} resonance. In connection with the site inhomogeneity problem, some CARS and CSRS data are also presented for cresyl violet in polyacrylic acid. 45 refs., 9 figs., 5 tabs.

44804 (IS-T—1212) Description of chemical reactions by the method of the Full Optimized Reaction Space. The ring-opening of unsubstituted and substituted cyclopropylidene to allene. Valtazanos, P. (Ames Lab., IA (USA)). Jul 1985. Contract W-7405-ENG-82. 203p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85015562.

Thesis.

The ring-opening reaction of singlet cyclopropylidene to singlet D/sub 2d/ allene is studied by means of ab-initio FORS-MCSCF calculations. The energy surface is determined for many intermediate geometries defined by the C-C-C opening angle and the two CH_2 rotation angles. For each choice of these three variables, the remaining twelve internal coordinates are relaxed by energy minimization. The results obtained differ markedly from those of earlier, less sophisticated calculations. Since experimental evidence, based exclusively on the substituted species, suggests that the reaction is stereospecific, a potential simulating the steric effects of substituents is added to the originally calculated surface. The results are analyzed and it is shown that all experimental observations can be adequately explained solely by means of nonbonded interactions between substituent groups. 92 refs., 27 figs., 20 tabs.

44805 (LA-UR—85-2375) Electron density distribution analysis for some nitrated cubanes. Ritchie, J.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 29p. (CONF-8506119—2). NTIS, PC A03. File Number DE85015670.

From Working group meeting on synthesis of high energy materials; Dover, NJ, USA (4 Jun 1985).

The investigators performed SCF molecular orbital calculations at fixed geometries for cubane, nitrocubane (NC), and 1,2-dinitrocubane (DNC) using the 3-21G basis set. Electron density distributions were then calculated from the approximate wavefunctions and subjected to various analyses. Fixed geometries and the small 3-21G basis set were used for reasons of comparison and economy. While these constraints limit the quantitative usefulness of the results, the investigators hope qualitative trends will be faithfully revealed. In all cases carbon-carbon and carbon-hydrogen bond lengths are 1.572 A and 1.076 A, respectively, and bond angles in the cubyl moiety were those of cubane. Carbon-nitrogen bonds and nitrogen-oxygen bonds were fixed at 1.44 A and 1.22 A, respectively, and the carbon-nitrogen-oxygen bond angles were set at 114.0°. In all cases the C-N bond lies along a body diagonal. In NC, symmetry group C/sub s/, the plane of the nitro group is in the symmetry plane. In DNC, symmetry group C_2, the planes of the nitro groups are canted 45° from a planar arrangement. 3 refs.

44806 (LA-UR—85-2410) Spectroscopic studies of carbon disulfide at high pressure. Agnew, S.F.; Swanson, B.I.; Eckhart, D.G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-850736—52). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015725.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

The authors have identified the pressure for the onset of CS_2 chemistry at ambient temperature and have correlated it with the several other indicators of increasing electronic interaction. They further explained the rather small shift of ν_1 and ν_3 with pressure as due to compensating effects of intermolecular repulsion and electronic ground-state mixing. Their measurement of the uv absorption edge with pressure matches that measured in an isothermal ramp shock and they have been able to estimate the temperature of a step shock at 2.4 GPa as well. There are further indications of various molecular and polymer species present as a result of their infrared work and the relative amounts of these species are affected by the temperature, pressure, and physical state of the CS_2. 14 refs., 6 figs.

44807 (LBL—19886) Properties of ethylene carbonate and its use in electrochemical applications: a literature review. Johnson, P.H. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 132p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85016526.

Thesis.

Ethylene carbonate ($C_3H_4O_3$) is an important industrial solvent and used extensively in the textile and cosmetic industry. Ethylene carbonate (EC) and propylene carbonate (PC) were tested for use as solvents for electrochemical applications. High chemical and electrochemical stability, low toxicity, good ionizing and solvating ability and low volatility make both EC and PC suitable solvents for electrochemical applications. Propylene carbonate has been used extensively in lithium batteries and nonaqueous electrochemical studies. The intent of this review is to stimulate the use of ethylene carbonate in nonaqueous electrochemistry. This review covers the literature up to January 1, 1985. 147 refs., 14 figs., 51 tabs.

44808 Study of the unimolecular decompositions of the $(C_3H_6)^+_2$ and $(c\text{-}C_3H_6)^+_2$ complexes. Tzeng, W.; Ono, Y.; Linn, S.H.; Ng, C.Y. (Ames Laboratory, U.S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **83**: No. 6, 2803-2812(15 Sep 1985). Contract W-7405-ENG-82.

The major product channels identified in the unimolecular decompositions of $C_3H^+_6xC_3H_6$ and $c\text{-}C_3H^+_6xc\text{-}C_3H_6$ in the total energy [neutral $(C_3H_6)_2$ or $(c\text{-}C_3H_6)_2$ heat of formation plus excitation energy] range of ~230—450 kcal/mol are $C_3H^+_7+C_3H_5$, $C_4H^+_7+C_2H_5$, $C_4H^+_6+C_2H_4$, and $C_5H^+_9+CH_3$. The measured appearance energy for $C_4H^+_7$(9.54 +- 0.04 eV) from $(C_3H_6)_2$ is equal to the thermochemical threshold for the formation of $C_4H^+_7+C_2H_5$ from $(C_3H_6)_2$, indicating that the exit potential energy barrier for the ion—molecule reaction $C_3H^+_6+C_3H_6\rightarrow C_4H^+_7+C_2H_5$ is negligible. There is evidence that the formations of $C_4H^+_7+C_2H_4+H$ from $(C_3H_6)^+_2$ and $(c\text{-}C_3H_6)^+_2$ also proceed with high probabilities when they are energetically allowed. The variations of the relative abundances for $C_4H^+_7$, $C_4H^+_8$, and $C_5H^+_9$ from $(C_3H_6)^+_2$ and $(c\text{-}C_3H_6)^+_2$ as a function of ionizing photon energy are in qualitative agreement, suggesting that $(C_3H_6)^+_2$ and $(c\text{-}C_3H_6)^+_2$ rearrange to similar $C_6H^+_{12}$ isomers prior to fragmentation. The fact that $C_6H^+_{11}$ is found to be a primary ion from the unimolecular decomposition of $(c\text{-}C_3H_6)^+_2$ but not $(C_3H_6)^+_2$ supports the conclusion that the distribution of $C_6H^+_{12}$ collision complexes involved in the $C_3H^+_6+C_3H_6$ reactions is different from that in the cyclopropane ion—molecule reactions.

44809 Study of the unimolecular decomposition of the $(C_2H_4)^+_3$ complex. Tzeng, W.; Ono, Y.; Linn, S.H.; Ng, C.Y. (Ames Laboratory, U. S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **83**: No. 6, 2813-2817(15 Sep 1985). Contract W-7405-ENG-82.

The energetics and dissociation dynamics of the $(C_2H_4)^+_3$ complexes have been studied by photoionization of neutral van der Waals ethylene trimers. The major product channels identified in the unimolecular decomposition of $(C_2H_4)^+_3$ in the total energy [neutral $(C_2H_4)_3$ heat of formation plus excitation energy] range of ~260—336 kcal/mol are $C_3H^+_6+C_3H_6$, $C_3H^+_7+C_3H_5$, $C_4H^+_7+C_2H_5$ (or C_2H_4+H), $C_4H^+_8$ [or $(C_2H_4)^+_2$]$+C_2H_4$, $C_5H^+_9+CH_3$, and $C_6H^+_{11}+H$. The fact that these product channels are similar to those observed in the unimolecular decompositions of $(C_3H_6)^+_2$ and $(c\text{-}C_3H_6)^+_2$ is consistent with the interpretation that the $(C_2H_4)^+_3$, $(C_3H_6)^+_2$, and $(c\text{-}C_3H_6)^+_2$ loose complexes rearrange to similar stable $C_6H^+_{12}$ ions prior to fragmenting. The ionization energies (IE) of $(C_2H_3)_3$ and $(C_2H_4)_4$ are determined to be 9.465 +- 0.036 (1310 +- 5 A) and 9.287 +- 0.034 eV (1335 +- 5 A), respectively. Using the known IE's of $(C_2H_4)n$, n = 2, 3, and 4, and the estimated binding energies of $(C_2H_4)_2$ x C_2H_4 and $(C_2H_4)_3$ x C_2H_4, the bond dissociation energies for $(C_2H_4)^+_2$ x C_2H_4 and $(C_2H_4)^+_3$ x C_2H_4 are deduced to be 9.2 +- 1 and 4.6 +- 1 kcal/mol, respectively.

44810 Kinetic study of partial oxidation of methane with nitrous oxide on a molybdena-silica catalyst. Khan, M.M.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Journal of Catalysis;* **91**: No. 2, 263-271(Feb 1985). Contract AC03-76SF00098.

Silica-supported molybedena has been found to catalyze the partial oxidation of methane to methanol and formaldehyde. Nitrous oxide as the oxidizing agent and the presence of water vapor in the reactant gas stream were necessary to carry out this reaction at the temperature range of 480-590°C and a total pressure of 1 atm. Highest turnover rates of methanol and formaldehyde were, respectively, 2.24 x 10^{-4} and 6.25 x 10^{-4} molec . s^{-1} . $site^{-1}$ at 590°C. The rate of methanol formation was first order with respect to methane and water, and zero order with respect to nitrous oxide; whereas the rate of formaldehyde formation was zero order with respect to all reactants. From activation energy measurements it was possible to identify a low- and a high-temperature mechanism of formaldehyde formation. Predominant at temperatures below 540°C were the processes leading to parallel formations of methanol (E/sub a/ = 41 kcal/mole) and formaldehyde (E/sub a/ = 82 kcal/mole) from the same intermediate, while at higher temperatures only the consecutive oxidation processes leading to formaldehyde via methanol with an overall E/sub a/ of 40 kcal/mole was the major route.

44811 Theory of intramolecular electron transfer reactions in anion radicals of nitrobenzyl halides. Miller, K.E.; Kazak, J.J. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **89**: No. 3, 401-403(31 Jan 1985).

Recently, we have suggested a lattice-based theory of chemical reactivity in which quantum and statistical mechanical arguments are combined to yield a method for calculating rate constants for dehalogenation of the ortho-, meta-, and para-substituted nitrobenzyl chloride anion radicals. Our theoretical results are obtained by calculating the π orbital spin populations of the anion radicals (MO calculations using the GAUSSIAN 82 series of programs), using the consequent values to distinguish the ortho, meta, and para sites, and then calculating the rate constants using a lattice statistical approach, the latter based on a theory presented recently. Apart from the limitations of the MO calculations and the neglect of solvent effects, the method involves no further assumptions or parameters. The theoretical estimates are in good agreement with the experimental rate constants. 10 refs., 2 figs., 1 tab.

44812 Molecular architecture in cyanine dye aggregates at the air-water interface. Effect of monolayer composition and organization on fluorescent behavior. Vaidyanathan, S.; Patterson, L.K.; Moebius, D.; Gruniger, H.R. (Univ. of Notre Dame, IN; Max-Planck Institute fuer Biophysikalishe Chemie, Goettingen, West Germany). *Journal of Physical Chemistry;* **89**: No. 3, 491-497(31 Jan 1985).

The fluorescence behavior of an amphiphatic oxacyanine dye and its thiacyanine analogue has been investigated in spread monolayers at the air-water interface. J-aggregate formation as a function of area/(dye molecule) was monitored by spectral changes in pure dye monolayers and in 1:1 mixtures of dye with various fatty acid coaggregates. Simultaneously, the thermodynamic behavior of these systems was characterized by the associated surface pressure-area isotherms. In all cases, J-aggregate formation may be related to a phase transition in the isotherm. The intensity of aggregate fluorescence is found to be inversely related to the work, ΔW, of compression of the monolayer through the transition. Inclusion of the fatty acid coaggregate was shown to facilitate J-aggregate formation in the order stearic > elaidic > oleic. Both fluorescence and thermodynamic data indicate more extensive aggregate formation in the thiacyanine systems. Aside from the paramount role played by the chromophore-chromophore interactions in determining J-aggregate phenomena, this study suggests important contributions from dispersion forces involving the long hydrocarbon moieties. 13 refs., 10 figs.

44813 Safe and convenient new procedure for reducing aromatic compounds to birch-type products. Benkeser, R.A.; Laugal, J.A.; Rappa, A. (Purdue Univ., West Lafayette, IN). *Tetrahedron Letters;* **25**: No. 20, 2089-2092(1984). Contract AC02-81ER10989.

Aromatic compounds can be reduced by a calcium-amine-t-butyl alcohol system to products which are identical to those obtained by a Birch reduction of the same substrates.

44814 Two-dimensional, computer-controlled film scanner: quantitation of fluorescence from ethidium bromide-stained DNA gels. Sutherland, J.C.; Monteleone, D.C.; Trunk, J.; Ciarrocchi, G. (Brookhaven National Lab., Upton, NY). *Analytical Biochemistry;* **139**: 390-399(1984).

A two-dimensional scanner based on a digital plotter is described. The device is used to analyze photographic negatives of ethidium bromide-stained DNA-agarose gels. Scanning is controlled by and photometric data transferred to a computer for processing, storage, display, and analysis such as integration of the areas under bands and determination of the mean distances of migration of polydisperse samples. An integral light source and detector module designed for reading optical bar-codes is mounted in place of the pen of the plotter. Spatial resolution and reproducibility are about 0.2 and 0.005 mm, respectively. Photometric precision as good as one part per thousand is achieved by sinusoidal modulation of the intensity of the light source and synchronous, phase-sensitive detection of the signal from the detector by a lock-in amplifier. No part of the sensor assembly touches the surface of the negative. In contrast to a densitometer, the computer transforms photometric data to values directly proportional to the amount of DNA at given points on the original gel. The ability to move the sensor in two dimensions over the negative allows for the integration across the width of a lane correctly allowing for the nonuniform distribution of the DNA.

44815 Effects of polyacrylic acid on the room-temperature phosphorescence of selected compounds. Senthilnathan, V.P.; Ramasamy, S.M.; Hurtubise, R.J. (Univ. of Wyoming, Laramie). *Analytica Chimica Acta;* **157**: 203-206(1984). Contract AC02-80ER10624.

Polyacrylic acid solutions of 4-phenylphenol, p-aminobenzoic acid, 1,2-benzocarbazole, and 5,6-benzoquinoline were spotted on filter paper, and the results obtained by room-temperature phosphorescence were compared with similar samples spotted on filter paper without polyacrylic acid. Improvements in sensitivity ranged from 26 times to 1.1 times and limits of detection from 100 times to 1.1 times for the samples on filter paper with polyacrylic acid. The relative standard deviations for the samples with polyacrylic acid added were also improved.

44816 Stability and structure of β-fluoro-substituted radical anions of acetamides. An EPR study at 3 K. Samskog, P.O.; Kispert, L.D.; Murray, D.P. (Univ. of Alabama, Tuscaloosa). *Chemical Physics Letters;* **101**: No. 1, 106-110(7 Oct 1983).

An electron proton resonance (EPR) study at 3 K of x-ray irradiated monofluoroacetamide does not reveal a radical anion species, despite the fact that the radical anion in trifluoroacetamide is stable at 77 K. This difference in stability has been found to be dependent on the conformation of the $-CF_3$ group (eclipsed) versus the $-CFH_2$ group (staggered). The eclipsed conformation permits effective σ - π hyperconjugation in stabilizing the radical anion. An INDO calculation of $CF_3CONH_2^-$ suggests that the radical site is pyramidal rather than planar with a non-planar angle of 32° and a dihedral angle for the eclipsed fluorine, relative to the nearly π-like orbital, of 30°.

44817 L-ascorbic acid quenching of singlet delta molecular oxygen in aqueous media: generalized antioxidant property of vitamin C. Chou, P.T.; Khan, A.U. (Florida State Univ., Tallahassee). *Biochemical and Biophysical Research Communications;* **115**: No. 3, 932-937(30 Sep 1983). Contract AS05-78EV05855.

L-ascorbic acid quenches singlet ($^1\Delta$/sub g/) molecular oxygen in aqueous media (pH 6.8 for $[^1H]H_2O$ and pD 7.2 for $(^2H)D_2O$) as measured directly by monitoring (0,0) $^1\Delta$/sub g/ → $^3\Sigma$/sub g/$^-$ emission at 1.28 micron. Singlet oxygen was generated at room temperature in the solutions via photosensitization of sodium chrysene sulfonate; this sulfonated polycyclic hydrocarbon was synthesized to provide a water soluble chromophore inert to

usual dye-ascorbate photobleaching. A marked isotope effect is found; k/sub Q//sup H_2O/ is 3.3 times faster than k/sub Q//sup D_2O/, suggesting ascorbic acid is chemically quenching singlet oxygen.

44818 **Purification of oleic acid and linoleic acid.** Arudi, R.L.; Sutherland, M.W.; Bielski, B.H.J. (Brookhaven National Lab., Upton, NY). *Journal of Lipid Research;* **24**: 485-487(1983).

To permit kinetic studies of the reactivity of unsaturated fatty acids towards oxygen radicals, it is essential to remove traces of hydroperoxides and other conjugated lipid impurities commonly present in commercial samples. Removal of these impurities has been satisfactorily achieved for oleic and linoleic acids by anaerobic low temperature recrystallization from acetonitrile. The uv spectra of commercial and purified samples are compared.

44819 **Organotellurium compounds of biological interest - unique properties of the N-Chlorosuccinimide oxidation product of 9-telluraheptadecanoic acid.** Kirsch, G.; Goodman, M.M.; Knapp, F.F. Jr. (Oak Ridge National Lab., TN). *Organometallics;* **2**: No. 3, 352-363(1983). Contract W-7405-ENG-26.

The product formed by N-chlorosuccinimide (NCS) oxidation of 9-telluraheptadecanoic acid (9-THDA) is insoluble in organic solvents and appears to have an oligomeric or polymeric structure. The product is solubilized in dilute base to the sodium salt of the monomer, the Te(IV) geminal diol of 9-THDA. While the insoluble oxidation product cannot be analyzed directly, it has been converted to products of known structure. Treatment with HBr gives the dibromide of 9-THDA, and treatment wit acetic anhydride forms the Te(IV) geminal diacetate of 9-THDA. Similar NCS oxidation of the methyl ester of 9-THDA or dioctyl telluride in each case gives the Te(IV) geminal diols that exhibit normal solubility in organic solvents and the expected physical properties. In contrast, NCS oxidation of 9-selenaheptadecanoic acid (9-SHDA) gives a selenoxide (Se=O) that is readily soluble in organic solvents. The contrasting properties of the oxidation products of 9-THDA and 9-SHDA correlate directly with the heart specificity and degree of retention in the heart muscle after intravenous administration of the radiolabeled compounds 9-[/sup 125m/Te]THDA and 9-[^{75}Se]SHDA to experimental animals. The radiolabeled tellurium fatty acid shows pronounced heart uptake and prolonged retention (trapping) and represents a new type of imaging agent for the potential clinical evaluation of heart disease. The present studies suggest that the trapping of tellurium fatty acids in the heart may result from the formation of an insoluble oxidation product after entry into the cells of the heart muscle.

44820 **Synthesis and spectral properties of diethyl organylchalcogenoalkyl(alkyl)malonates, RX(CH_2)/sub n/CR'($COOC_2H_5$)$_2$, and 5-alkyl-5-(organylchalcogenoalkyl)barbiturates, RX(CH_2)/sub n/C(R')CONHC(Y)NHCO (X = Se, Te).** Grigsby, R.A. Jr.; Irgolic, K.J.; Knapp, F.F. Jr. (Texas A and M Univ., College Station). *Journal of Organometallic Chemistry (Amsterdam);* **259**: 171-181(1983). Contract W-7405-ENG-26.

Barbiturates substituted at the 5-position with organyltelluroalkyl or organylselenoalkyl groups were prepared by ring annulation of appropriately substituted diethyl malonates with urea or thiourea. The substituted diethyl malonates [phenyltellurobutyl(ethyl), i-propyltelluropropyl(ethyl), i-propyltelluropropyl(allyl), i-propylselenopropyl(ethyl), and phenylselenohexyl(methyl)] were prepared in 55-91% yield by reaction of diethyl omega-bromoalkyl(alkyl)malonates with organyltellurolates or selenolates (RXNa; X = Se, Te) in ethanol/benzene. The following barbiturates were obtained in 28-84% yield: phenyltellurobutyl(ethyl), m.p. 100°C; i-propyltelluropropyl(ethyl), m.p. 119°C; i-propylselenopropyl(ethyl), m.p. 137°C; phenyl-selenohexyl(methyl), m.p. 124°C. The 5-substituted thiobarbiturates i-propyltelluropropyl(ethyl)-(m.p. 75°C) and i-propylselenopropyl(ethyl)thiobarbiturate (m.p. 83°C) were isolated in 32 and 20% yield, respectively. The barbiturates and thiobarbiturates were purified by chromatography and recrystallization and characterized by elemental analyses, mass spectrometry, ^{1}H, ^{125}Te and ^{77}Se NMR spectroscopy and UV-VIS spectrometry. The chalcogenobarbiturates radiolabeled with /sup 123m/Te or ^{77}Se may be useful as brain imaging agents. 31 references, 4 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 44807

44821 **(AD-A—154163/0/XAB) Photoeffects of semiconductor electrolyte interfaces. Final report, 1979-1984.** Phillips, T.E.; Moorjani, K.; Murphy, J.C.; Poehler, T.O. (Johns Hopkins Univ., Silver Spring, MD (USA). Applied Physics Lab.). Mar 1985. 64p. NTIS, PC A04/MF A01.

Materials based on modified transition metal oxide semiconductors for the photoelectrochemical decomposition of H_2O were investigated. Single crystals of TiO_2 doped with VO_2 were made, and it was demonstrated that the bandgap was decreased from 3.03 eV to 1.99 eV. The flatband potential was increased from -1.0 V to 0, 25 V. Both effects are attributed to the existence of an empty vanadium d-band located in the TiO_2 bandgap. Another approach was taken with $FeTiO_3$-Fe_2O_3 alloys in the form of amorphous thin films and single crystals, where it was anticipated that the charge-transfer interactions observed in such alloys could be exploited in the materials photoelectrochemical properties. The effect of $FeTiO_3$ had very little effect on the overall properties of FE_2O_3 single crystals. On the other hand, the effect on the Fe/Ti oxide thin films was quite dramatic. Optical absorption, photoconductivity, and photoelectrolytic spectral measurement demonstrate a photometric enhancement at energies above the bandgap for Ti concentrations in the range of 5% to 8%. There is some suggestion that the bandgap has been reduced in this concentration regime. Higher concentrations of Ti result in a change from n-type to p-type. Efficiency and stability of thermally oxidized Fe/Ti oxide films are comparable to single-crystal results.

4005 Photochemistry

REFER ALSO TO CITATION(S) 44004, 44005, 44817, 44821, 44833, 44834, 45406

44822 **(AD-A—153693/7/XAB) Investigation of several low-lying levels of X doublet pi state of NCO using argon laser excited fluorescence. Final technical report.** Anderson, W.R.; Kotlar, A.J.; Vanderhoff, J.A.; Wong, K.N. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Dec 1984. 31p. (BRL/TR—2625). NTIS, PC A03/MF A01.

The laser-excited fluorescence spectrum of NCO from an atmospheric pressure $CH_4/N_2O/N_2$ flame is reinvestigated with a more sensitive apparatus than used previously. The NCO is pumped from the X doublet pi (1,O,O) level to the A doublet sigma plus (O,O,O) level. Emissions from the excited A state level to the following X state vibrational levels are observed: doublet pi (O,O,O), (1,0,0), and (O,O,1); doublet sigma plus (O,1,O). The previous tentative assignment of pumping transition as Q2(31) is confirmed. The confirmation of pumping transition solidifies our earlier interpretation that excited-state spin relaxation in the flame is much faster than electronic quenching. In addition, analysis of the fluorescence spectra yields the first reported constants for the X doublet pi (1,O,O) level and spin splitting for the X doublet pi (O,O,1) level in the gas phase.

44823 **(DOE/ER/04452—T1) Study of photosensitized Redox reactions in microemulsions. Final report.** Mackay, R.A.; Longo, F.R. (Drexel Univ., Philadelphia, PA (USA). Dept. of Chemistry). 1984. Contract AC02-77ER04452. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015380.

In this investigation both ionic (anionic and cationic) as well as non-ionic oil-in-water microemulsions have been used for various physico-chemical studies. The microemulsion systems employed are: sodium cetyl sulfate-heavy mineral oil-n-pentanol-water; cetyl trimethylammoniumbromide-hexadecane-n-pentanol-water and Brij-96-n-butanol-mineral oil-water. Porphyrin sensitized photoreduc-

tions of azo dyes have been extensively studied primarily in buffered Brij-96 microemulsion with limited studies in ionic systems. The experimental quantum yields for the reaction are normally in the range 0.10 to 0.27. The effect of nature of porphyrin, reducing reagent, reaction product(s), oxygen concentration and emulsion type on the experimental quantum yields are investigated. 8 tabs.

44824 **(DOE/ER/10745—T1) [Charge separation in photoredox reactions]. Informal annual technical progress report, October 1, 1981-October 1, 1982.** Kevan, L. (Houston Univ., TX (USA). Dept. of Chemistry). 21 Oct 1982. Contract AS05-80ER10745. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016845.

During this period work has focused on the structural aspects of photoinduced charge separation in micellar media with initial forays into vesicular media. The primary techniques utilized are electron spin resonance and electron spin echo spectrometry. The analysis of electron spin echo modulation gives a unique handle on very weak hyperfine interactions thus providing a new structural tool for this general problem. Electron spin resonance and electron spin echo studies of the photoionization of N,N,N',N'tetramethylbenzidine (TMB) to give the cation radical have been carried out in anionic, cationic and nonionic micellar solutions frozen to 77°K. The photoionization efficiency of TMB has also been studied in micelles with varying alkyl chain lengths of the surfactant. Stearic acid nitroxide spin probes have also been used to determine some structural aspects of the location of the neutral TMB molecule in anionic micelles before photoionization. The nitroxide work in which the nitroxide is acting as an electron acceptor also shows that a suitable electron acceptor can be located within the micellar structure. The effect of inorganic solutes on the efficiency of the photoionization of TMB in frozen micelles has also been studied. A series of electron scavenger studies have been initiated to study the effect on TMB photoionization efficiency. Electron spin echo detection of laser photogenerated TMB cation in liquid sodium dodecyl sulfate solutions at room temperature has recently been observed.

44825 **(FRNC-TH—1775) Photodissociation of water molecule. Photoreduction of carbon dioxide molecule.** Ziessel, R. (Strasbourg-1 Univ., 67 (France)). Dec 1982. 506p. (In French). NTIS (US Sales Only), PC A22. File Number DE85751287.

Hydrogen production from water using energy from ultraviolet radiation is studied. Catalysts for photochemical oxidation of water in particular bipyridine complexes of transition metals and system parameters (pH, temperature, time) are examined. Then photochemical reduction of CO_2 in CO in visible light using a tertiary amine as an electron donor is also examined.

44826 **(PB—85-194017/XAB) Photochemical dissociation of water in colloidal clay suspensions.** Nijs, H.; Bergaya, F.; Challal, D.; Fripiat, J.J.; van Damme, H. (Commission of the European Communities, Luxembourg). 1984. 41p. (EUR—9134-EN). NTIS, PC E03/MF E03.

In order to construct a photolytic cell for water based on mixed inorganic colloids, as proposed for this project, the different variables playing a role in such a system were closely investigated. New catalysts and electron acceptors were developed to achieve true catalytic light-induced water splitting. It was shown by so called sacrificial reactors that, when clay minerals are used in such systems, steric factor might prevent the reaction to proceed. A judicious choice of the clay mineral to be used is necessary. Efficient clays are in fact those that have a negligible internal surface. The same type of sacrificial reactions permitted the development of electron acceptors embedded in positively charged Al(OH)x colloids. These acceptors are the hydroxides of Eu, Sm and In. Their physicochemical behavior in the reduction of water is described in detail. It is further shown that the combination of the negatively charged clay colloid, charged with a photosensitizer, and the positively charged acceptor colloid leads to the cyclic photolysis of water by visible light. This photodissociation is often periodic and the system is rapidly poisoned. The origin of the latter phenomenon is still to be clarified.

44827 **(PB—85-204600/XAB) Vectorial electron transfer on designed surfaces. Annual report, January 1984-January 1985.** Bard, A.J.; Campion, A.; Fox, M.A.; Webber, S.E.; White, J.M. (Texas Univ., Austin (USA). Dept. of Chemistry). 15 Mar 1985. 94p. NTIS, PC A05/MF A01.

See also PB84-198530.

Several systems have been investigated for photochemical-water systems and the chemical and physical factors that govern their efficiencies have been studied. For platinized CdS particles immobilized in a polymer (Nafion) matrix the induction period for H_2 formation has been shown to correlate with the extent of reduction of the initiallY partially oxided Pt catalyst. The crystalline form of the CdS can be controlled by the precipitation conditions. Cubic CdS, which is more active for H_2 generation, has a much rougher surface that is rich in sulfate. On the other hand, hexagonal CdS has a much smoother surface, which is covered by sulfide. A novel mixed semiconductor system ZnS:CdS was discovered, which is nearly as active as the platinized CdS system. This is the first example of efficient photocatalysis for this reaction that does not require a noble metal to catalyze H_2 evolution. The performance of the ZnS:CdS system is shown to be essentially indifferent to the nature of the support which has been silica, alumina or nylon mesh as well as the original Nafion.

44828 **Colloidal catalyst coated semiconductors in surfactant vesicles. In situ generation of rhodium-coated cadmium sulfide particles in dioctadecyldimethylammonium halide surfactant vesicles and their utilization in photosensitized charge separation and hydrogen generation.** Rafaeloff, R.; Tricot, Y.M.; Nome, F.; Fendler, J.H. (Clarkson Univ., Potsdam, New York). *Journal of Physical Chemistry;* **89**: No. 3, 533-537(31 Jan 1985).

Colloidal ca. 40 A diameter CdS semiconductors have been in situ generated and in situ coated by rhodium in 800 to 1000 A diameter dioctadecyldimethylammonium chloride (DODAC) and dioctadecyldimethylammonium bromide (DODAB) surfactant vesicles. Vesicles controlled the size and stabilities of CdS, generated by H_2S from adsorbed Cd/EDTA. Fluorescence emission of DODAC or DODAB vesicle incorporated CdS was visible only when the dispersion was sonicated at a pH higher than 6. This fluorescence was unaffected by additional EDTA but efficiently quenched by PhSH. Direct evidence of conduction of DODAC and DODAB vesicle entrapped Rh-coated CdS particles in the presence of PhSH (the sacrificial electron donor) has led to hydrogen formation which could be sustained until nearly complete consumption of PhSH. Hydrogen evolution was equally more efficient from externally formed CdS particles, even though they did not show a detectable fluorescence. Hydrogen generation has been optimized by examining the effect of catalyst concentration, its mode of formation, the concentration of added PhSH, and the methods of CdS and vesicle preparation. 45 refs., 6 figs., 1 tab.

44829 **Exciplex formation in alcohol and water solutions of 7-azaindole.** Collins, S.T. (Florida State Univ., Tallahassee). *Journal of Physical Chemistry;* **87**: No. 17, 3202-3207(1983). Contract AS05-78EV05855.

The unusual long-wavelength shift and bandwidth of the fluorescence spectra of 7-azaindole in alcohol and water solutions compared with hydrocarbon solution is demonstrated to be the result of exciplex formation between the 7-azaindole and the hydroxylic solvent molecules. The technique of monitoring the fluorescence band position, intensity, and half-width (fwhm) in alcohol-hydrocarbon solutions as developed by Walker et al. has been used to distinguish the exciplex model from other existing models. Aggregation effects and the dependence of the exciplex fluorescence yield on alcohol acidity have led to a model attributing excited-state charge transfer between the nonbonding oxygen electrons in the alcohol and the lowest vacant π orbital of excited 7-azaindole. It also has been demonstrated that excited-state double proton transfer between 7-azaindole and a single alcohol molecule occurs, independent of the exciplex formation, for molecules that form a cyclic hydrogen-bonded complex in the ground state.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 44772

44830 (AD-A—154376/8/XAB) Nitrogen chemistry in sea-level air following large radiation doses. Technical report, 1 February 1980-30 September 1981. Scheibe, M. (Mission Research Corp., Santa Barbara, CA (USA)). 15 Jun 1984. 37p. (MRC-R—845). NTIS, PC A03/MF A01.

The electron densities near a large yield nuclear burst during the first few seconds can impact the performance of terminal defense radars. The main chemical parameters that determine the electron density in this situation are the electron attachment and detachment rates. This report describes work done to determine the production of HNO_3 and N_2 0 the results of an experiment done at Oak Ridge were used to revise the reaction scheme used in the chemical-integration code used to simulate the nuclear case. It was found that the irradiation time is a critical factor in the production of HNO_3. An order of magnitude or more less HNO_3 was produced in the nuclear cases simulated than in the laboratory experiment where the irradiation times were longer. HNO_3, however, might still be an important attacher of electrons in the nuclear case. The bomblight does not appear to affect very strongly the electron densities in the air outside the fireball. The delayed gamma-ray radiation tends to overwhelm the bomblight effect.

44831 (CEA-CONF—7311) Gamma radiolysis of glucose and relative compounds: a spin-trapping study. Raffi, J.; Thiery, C.; Vincent, P.; Agnel, J.P.; Boizot, C. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Jun 1984. 7p. (In France). (CONF-8406258—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751155.

From Colloquium on radiation chemistry; Mont-Saint-Odile, France (12 Jun 1984).

Gamma-induced radicals in polycrystalline α-D-glucose, 1-methyl α D glucose and maltose were trapped with a water-ethanol solution of 2-nitroso-2-methylpropane. Respectively 9, 7 and 9 long-lived nitroxide spin adducts were evidenced by combining electron spin resonance and high performance liquid chromatography experiments. A proposed mechanism from spin trapping assays is compared to the ones postulated from other ESR and radio-chemical studies.

44832 (CEA-CONF—7719) Study of lead and cadmium cryptate reduction by pulsed radiolysis. Lardinois, P.; Rebena, I.; Hickel, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1984. 1p. (In French). (CONF-8406258—1-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752063.

From Colloquium on radiation chemistry; Mont-Saint-Odile, France (12 Jun 1984).

Published in summary form only.

44833 (CEA-CONF—7730) Study of structured mixtures water-dextran by radiolysis and photolysis. Case of electron transfer between zinc porphyrin and methylviologen. Koulkes-Pujo, A.M.; Tran Thi, T.H.; Petit, B.; Folcher, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 1p. (In French). (CONF-8409240—1-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752057.

From French Society of Chemistry congress; Nancy, France (17 Sep 1984).

Published in summary form only.

44834 (DOE/ER/03106—86) Radiation chemistry of hydrocarbon and alkyl halide systems. Interim progress report, June 1, 1984-July 31, 1985. Hanrahan, R.J. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1985. Contract AS05-76ER03106. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016900.

Experimental work in progress includes studies of gas phase OH radical reaction using argon sensitized pulse radiolysis and studies of the radiolytic oxidation of butane. Work on interpretation of results, writing, and revision of manuscripts is still in progress on several investigations including studies of the photochemistry and mass spectrometry of CF3I-CH3I mixtures; an investigation of the radiolytic oxidation of propane; and certain parts of the study of radiolytic reactions in the H_2 - CO system. Work on experimental aspects of the radiolytic oxidation of butane nearing completion. It appears that the results do parallel the propane system as we anticipated, with major products being the C_4 alcohols and olefins.

44835 (INIS-mf—9740, pp 65) Pulse radiolytic study of the application of 1,2,4,5-tetramethoxybenzene as an electron transfer reagent in solar energy conversion systems. Brandeis, M.; Sassoon, R.E.; Rabani, J. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44836 (JAERI-M—83-229) Radiolysis of methane-ethylene and methane-ethane mixtures flow system induced by electron irradiation using none-recycling. Hatada, Motoyoshi; Sugimoto, Shun-ichi. (Japan Atomic Energy Research Inst., Tokyo). Jan 1984. 51p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85701862.

The main products from irradiated methane are hydrogen and ethane, but by further irradiation above 10^4 Mrad, methane are converted mainly to hydrogen and liquid hydrocarbons. In order to know the reaction scheme by which ethane is produced from methane by irradiation and that by which the once produced ethane is consumed by further irradiation, studies have been carried out on radiation chemical reactions of methane containing 0–2 mol % ethylene or ethane induced by electron beam irradiation using non-recycling flow system. The G-value of hydrogen formation decreased by the addition of small amounts of ethylene and that of ethane increased to maximum and then decreased by increasing ethylene content. The G-values of higher hydrocarbon products (C_3 or higher) increased with increasing ethylene content. The G-value of hydrogen formation was independent of ethane concentration. The G-values of higher hydrocarbon products increased with increasing ethane content, but the increased amounts of the G-values were not as large as those observed for ethylene addition. These results indicate that ethane and higher hydrocarbon products produced via ethylene and ethane thus produced was converted to higher hydrocarbons by continued irradiation.

44837 Electron T_1 measurements in short-lived free radicals by dynamic polarization recovery. Bartels, D.M.; Lawler, R.G.; Trifunac, A.D. (Chemistry Department, Brown University, Providence, Rhode Island 02912). *Journal of Chemical Physics;* **83**: No. 6, 2686-2707(15 Sep 1985). Contract W-31-109-ENG-38.

A dynamic polarization recovery method for measurement of electron spin T_1 relaxation times in free radicals in liquids is described, which is valid even in the presence of chemically induced dynamic electron polarization (CIDEP) and fast chemical decay of the radicals. The method is based on pulsed microwave perturbation and detection of transient magnetization following radical creation in a short pulse. Analysis of the experimental approach and a theoretical description of the method is presented together with a detailed discussion of the advantages and the limitations of the technique. Electron T_1 measurements are presented for 14 short-lived free radicals generated in aqueous solution. The magnitudes of the observed relaxation times, which range from 0.1 to 4 μs, are discussed within the framework of current theories of relaxation for small radicals in liquids. It is tentatively concluded that the spin rotation mechanism is responsible for the very short T_1's in this series of radicals.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 43812, 43816, 43889, 43912, 43913, 44727, 44753, 44986

44838 (AECL—7817) Assessment of the thermodynamic behaviour of neptunium in water and model groundwaters from 25 to 150 degrees C. Lemire, R.J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Mar 1984. 62p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84901537.

Standard molal Gibbs energy of formation and entropy data for simple neptunium solids and aqueous neptunium complexes with OH^-, Cl^-, F^-, CO_3^{2-}, PO_4^{3-}, $SO\text{-}4^{2-}$ and Na^+ have been critically reviewed. Selected values are used with estimated heat capacity values to derive self-consistent analytical expressions for the temperature dependence of the standard molal Gibbs energies of formation of the species from 25 to 150 degrees C. The Gibbs energies have been used to evaluate the effect of different concentrations of ligands on the solubility of neptunium solids as a function of temperature. Potential-pH diagrams are given for neptunium in pure water and in two model groundwaters. Important deficiencies in the available thermodynamic data for neptunium species are discussed.

44839 (AECL—7986) Improved radiochemical method for the isolation of uranium from other actinides in urine. Desai, N.; Kramer, G.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701967.

The Bioassay Laboratory at CRNL estimates uranium in urine by extraction with TBP (tributyl phosphate) and alpha counting. Studies performed on this method revealed several disadvantages: other actinides follow uranium and the overall recovery of uranium is not high. Cross-contamination studies showed that plutonium-239, neptunium-237, thorium-natural and curium-244 were all present in the final uranium source (Pu-239, 60 percent; Np-237, 48 percent; Th-nat, 40 percent; Cm-244, 15 percent). The overall uranium recovery was about 60 percent. The method has since been modified to improve the uranium recovery to 85 +- 5 percent and completely eliminate actinide cross-contamination by the inclusion of some selective co-precipitation steps after the TBP extractions have been carried out.

44840 (CEA-CONF—7718) Reaction of two amino-acids: alanine and threonine with UF_6 in anhydrous HF. Nguyen-Nghi; Phan Van Chuong, P.; Beaucourt, J.P.; Lellouche, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1984. 1p. (In French). (CONF-8411170—1-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752055.

From National colloquium on fluorine and fluorinated compounds; Bordeaux, France (15 Nov 1984).

Published in summary form only.

44841 (CNEA-NT—7/82) Identification of radioactive minerals by means of X-rays. Toubes, R.O. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). May 1982. 63p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85701861.

As a result of a thorough revision of the extensive bibliography from different sources avialable to the author, an updated compilation (up to December, 31st., 1981) was made of the fundamental parameters for the identification, by means of X-rays, of the radioactive minerals and of those which can behave as such as a consequence of an eventual incorporation of radioactive chemical elements. The data is arranged in 3 sections: the first one is an Entry Register which, on the basis of the five strongest lines or the diagram, allows to readily find out the species whose main X-rays spacings are closest to those of the samples being identified. In the second section, the species are listed in alphabetical order, together with their corresponding X-ray spacings and a description of their mineralogical, chemical and physical characteristics, as well as any other useful data to facilitate correct identification of the samples. The third and last section is a catalogue of the radioactive minerals grouped according to their anions.

44842 (CONF-840807—6) Chemical thermodynamic representations of <PuO/sub 2-x> and <U/sub 1-z/Pu/sub z/O/sub w/>. Besmann, T.M.; Lindemer, T.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016389.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

All available oxygen potential-temperature-composition data for the calcium fluorite-structure <PuO/sub 2-x/> phase were retrieved from the literature and utilized in the development of a binary solid solution representation of the phase. The data and phase relations are found to be best described by a solution of [Pu/sub 4/3/O_2] and [PuO_2] with a temperature dependent interaction energy. The fluorite-structure <U/sub 1-z/Pu/sub z/O/sub w/> is assumed to be represented by a combination of the binaries <PuO/sub 2-x/> and <UO/sub 2+-x/>, and thus treated as a solution of [Pu/sub 4/3/O_2], [PuO_2], [UO_2], and either [U_3O_{4-5}] or [U_3O_7]. The resulting equations well reproduce the large amount of oxygen potential-temperature-composition data for the mixed oxide system, all of which were also retrieved from the literature. These models are the first that appear to display the appropriate oxygen potential-temperature-composition and phase relation behavior over the entire range of existence for the phases. 39 refs., 10 figs., 3 tabs.

44843 (INIS-mf—9740, pp 112) Oxidation of tervalent uranium Usub(aq)sup(3+) by free radicals in aqueous solutions. Cohen, H.; Golub, D.; Meyerstein, D. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

44844 (IPNO-T—83-03) Study of optical properties of protactinium IV ($5f^1$) in $ThBr_4$ and $ThCl_4$ matrices. Foyentin, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1983. 97p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751213.

This thesis introduces spectroscopy studies of protactinium (IV) which are realized in $ThBr_4$ and $ThCl_4$ host matrices. The optical polarized spectra are reported in the infrared region between 4.2K and 300K. The most important point is the first observation of the Pa^{4+} fluorescence spectrum. We determined experimentally the energy of all the Stark levels of tetrapositive protactinium ion doped into $ThBr_4$. Consequently the values of the crystal field parameters and the spin-orbit coupling constant are deduced. The same behaviour for Pa^{4+}:$ThBr_4$ and Pa^{4+}:$ThCl_4$ characterized different interactions when the electron (5f1) comes in a different crystal field.

44845 (KFK—3853) Behavior and mechanism of sorption of uranylperoxocarbonato-complexes on anion exchanger systems. Wukovnig, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Jan 1985. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751911.

Faced with the problems of recycling nuclear fuel residues remaining in fission nuclide production plants after alkaline extraction of irradiated fuel element targets from aluminum alloyed highly enriched uranium, we developed a method of decontamination by extraction chromatography on the basis of the complexing dissolution of uranium in a hydrogen peroxide bearing carbonate medium. In static and dynamic distribution experiments the influence was investigated of process relevant parameters, such as the uranium:carbonate:hydrogen peroxide ratio, contact time, hydrogen ion activity, uranium loading, cross linkage, grain size, and preequilibration, on the sorption of the uranyl peroxocarbonato complexes formed on a strongly basic exchanger with functional quarternary

amine groups (AG 1). With the help of the UV-Vis, infrared and laser Raman spectroscopy, liquid scintillation counting, and gravimetric methods as well as volumetric analysis the stoichiometric coefficients were determined for the uranyl peroxocarbonate species fixed on the exchanger. It was possible to understand the mechanism underlying uranium sorption on the exchanger from the course of the distribution equilibrium curves while varying the experimental conditions. It has been demonstrated that uranium is bound to the ion exchanger resin as dimeric diuranyl monoperoxocarbonato complexes with distribution coefficients of up to 200,000 ml/g. The first step in the formation of the dimer should be the sorption of an uranyl tricarbonate anion which dimerizes with the monomeric peroxo complex present in excess. In further experiments the solubility and the exchange equilibria were studied of the fission nuclides cerium, niobium, ruthenium and zirconium under process relevant conditions.

44846 (LA—10417-MS) Crystal data for PuS/sub 2-x/ and α-Pu_2S_3. Roof, R.B. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016211.

An examination of X-ray powder diffraction films of materials labeled PuS_2 and PuS/sub x/ has been made. It is postulated that the material labeled PuS_2 is PuS/sub 2-x/. For a tetragonal cell with a_0 = 7.91085 +- 5 and c_0 = 7.9868 +- 16 A reasonable interatomic distances and observed-calculated intensity comparisons are obtained. For PuS/sub x/ a complicated pattern is observed that is identified as α-Pu_2S_3, a low temperature polymorph of Pu_2S_3. Indexing is based on an orthorhombic unit cell with a_0 = 7.374 +- 4, b_0 = 3.979 +- 2, c_0 = 15.372 +- 8 A, space group Pnma. α-Pu_2S_3 is isostructural with Gd_2S_3.

44847 Absorption spectrum of plutonium hexafluoride in the 3000-9000 A spectral region. Walters, R.T.; Briesmeister, R.A. (Los Alamos National Lab., NM). *Spectrochimica Acta, Part A: Molecular Spectroscopy;* **40A**: No. 7, 587-589(1984).

The absorption spectrum of PuF_6 is investigated using a long-pass multiple reflection cell. Cross sections over the spectral region of 3000-9000 A are reported. Due to the enhanced sensitivity of our apparatus the wavelengths and absorption cross sections are significantly improved over the previously available data.

44848 Magnetic susceptibility of curium pnictides. Nave, S.E.; Huray, P.G.; Peterson, J.R.; Damien, D.A.; Haire, R.G. (Oak Ridge National Lab., TN). *Physica (Amsterdam);* **107B**: 253-254(1981). Contract AS05-79ER10348;AS05-76ER04447;W-7405-ENG-26.

The magnetic susceptibility of microgram quantities of ^{248}(mP and ^{248}CmSb has been determined with the use of a SQUID micromagnetic susceptometer over the temperature range 4.2-340 K and in the applied magnetic field range of 0.45-1600 G. The fcc (NaCl-type) samples yield magnetic transitions at 73 K and 162 K for the phosphide and antimonide, respectively. Together, with published magnetic data for CmN and CmAs, these results indicate spatially extended exchange interactions between the relatively localized 5f electrons of the metallic actinide atoms.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 44554, 44921

44849 (AD-A—154056/6/XAB) Injection, atomization, ignition, and combustion of liquid fuels in high-speed air streams. Annual scientific report, 1 December 1982-30 November 1983. Schetz, J.A. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Aerospace and Ocean Engineering). Jan 1984. 16p. (VPI-Aero—136). NTIS, PC A02/MF A01.

Experimental and numerical studies of liquid and slurry-jet penetration, break-up, and atomization were performed. The measurements were done mainly at Mach 3.0 with P sub 0 = 4 atm. and T sub 0 = 300 K. Brief summaries of recent progress on various tasks are given.

44850 (DOE/ID/12463—1) Research into a spectral flame analyzer. Phase 1. Final report, April 21, 1983-June 30, 1985. Fraim, F. (Thermo Electron Corp., Waltham, MA (USA). Thermal Products Div.). 1 Jun 1985. Contract AC07-83ID12463. 86p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017031.

Optimum continuous combustion control of a multiple burner can be achieved only if each individual burner can be continuously checked. The most promising method to achieve individual control is based on spectral emission from each burner flame. The intensity of certain emissions from chemical species formed during combustion are indicative of the fuel-air ratio of the burner. An optical monitor tuned to these emission bands provides the needed burner control signal. Early tests with the Spectral Flame Analyzer demonstrated the potential of this approach, but unpredictable results indicated that the problem is more difficult than the original system was designed for. Controlled laboratory tests indicated that spectral measurements in the ultraviolet spectrum are essential for flame quality prediction, in addition to the infrared measurements made by the original design. This report covers the work involved in adding the ultraviolet measurement capability of the original design and the initial test results with the improved system. These initial tests with gas, oil, and coal-water slurry fuels indicated that the new design is a clear improvement over the original unit.

44851 (FRNC-TH—1584) Structure of the temperature field in a cold turbulent flame. Zarrad, N. (Paris-6 Univ., 75 (France)). Dec 1982. 107p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750557.

An experimental study of the mean thermal field and temperature fluctuations in a cold turbulent flame is presented. The turbulent thermal field in an air flow with an axial temperature gradient is studied. A spectral analysis of the temperature fluctuations is made and the probability density function for the temperature in the cold turbulent flame is reported.

44852 Derivation and numerical solution of the equations for zero Mach number combustion. Majda, A.; Sethian, J. (California Univ., Berkeley). *Combustion Science and Technology;* **42**: 185-205(1985). Contract AC03-76SF00098.

A limiting system of equations is presented to describe combustion processes at low-Mach number in either confined or unbounded regions and these equations are solved numerically for the case of a flame propagating in a closed vessel. This system allows for large heat release, substantial temperature and density variations, and substantial interaction with the hydrodynamic flow field, including the effects of turbulence. This limiting system is much simpler than the complete system of equations of compressible reacting gas flow since the detailed effects of acoustic waves have been removed. Using a combination of random-vortex techniques and flame-propagation algorithms specially designed for turbulent combustion, a numerical method to solve these zero-Mach number equations is described. This method is used to analyze the competing effects of viscosity, exothermicity, boundary conditions, and pressure on the rate of combustion for a flame propagating in a swirling flow inside a square. 22 references.

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4201 General Engineering

44853 (UCID—19323-84-3, pp 69-83) Solid geometric modeling. Vickers, D.L.; Taylor, L.E.; Kong, M.K.; Weisinger, R.B.; Laguna, G.W.; Kalibjian, J.R. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Solid geometric modeling is a technology which has great advantages over existing edge and surface modeling. It is the basis of the next generation of computer-aided design (CAD) systems for mechanical engineering. Though many applications exist for solid geometric modeling at the Laboratory, no commercial systems meet all of our needs. This project addresses the Laboratory's requirement for advanced solid-modeling technology and lays the

foundation for the eventual widespread use of that technology at LLNL.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 43820, 43822, 43832, 43833, 43834, 43854, 44084, 44085, 44306, 44343, 44895, 44896, 44911, 44972, 45040

44854 (CONF-8506106—2) Robotic design analysis based on teleoperated manipulator data collection. Stoughton, R.S.; Martin, H.L. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016404.

From Robots 9 conference; Detroit, MI, USA (2 Jun 1985).

Extensive data collection was performed on a servomanipulator system (TeleOperator Systems SM-229) to determine the motion range and mechanical power usage of the manipulator under direct human control. More than 50 hours of various manipulation operations were performed while joint positions and motor currents were recorded. Reduction of these data yielded histograms of the manipulator usage patterns revealing areas where future manipulator motion ranges and drive systems could be optimized. This report develops a graphical representation of mechanical power usage that relates torque and velocity to the total usage time. Methods of interpreting this representation are discussed and generalized for use in analyzing robotic systems. The resulting technique will allow designers to reevaluate an operating system and determine how to improve that system's design.

44855 (DOE/CE/15128—T1) Tubular pneumatic conveyor pipeline. Final technical report. Ply, L.L. (Ply International, Inc., Wimberley, TX (USA)). Jun 1985. Contract FG01-82CE15128. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017044.

Contains information published in US Patent No. 4,220,426.

A section of pneumatic conveying system was constructed and tested at the Milchem Barite Grinding Plant located at Galveston, Texas. Granular Barium Sulphate (barite) was used as the test material. A range of tests were conducted and modifications made to the fluidizing line and uni-directional valves to optimize the efficiency of the system. The test line proved superior to conventional pneumatic conveying lines by increasing the product conveying rate from fifty-six (56), tons per hour with a conventional system to one hundred and forty (140) tons per hour. The low vent loss of 2.1% was due to the test line's ability to convey a denser product flow without line plugging than possible with dilute phase conventional systems. The test line was deliberately plugged with material and rapidly unplugged during a series of tests to determine shutdown and start-up capability. This system may be retro-fitted to existing conventional pneumatic conveying lines with only minor modifications.

44856 (DOE/R2/05273—T1) Construction, testing, and evaluation of Schmidt folding-wing water turbine prototype. Final report. Tricamo, S.J. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Mechanical Engineering). 25 Jul 1983. Contract FG42-81R205273. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015626.

The construction, testing and evaluation of Mr. Friedrich Schmidt's invention of a folding-blade water turbine was performed at Stevens Institute of Technology. Although overall measured efficiency was low, the folding wing action resulted in a significant advantage when compared to operation of the device with wings locked in the open position. Recommendations for further development and future investigation of the device are also made.

44857 (EGG—10282-2074) Efficient optical analog signal amplification by backward Raman scattering. Lin, C.H.; Nelson, M.A. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Operations). 1985. Contract AC08-83NV10282. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017163.

Analog signals have been amplified by backward Raman scattering in a multimode graded-index fiber. A gain of 28.5 dB and excellent time profile fidelity have been achieved.

44858 (FRNC-TH—1971) Contribution to study and realization of 20-Tesla superconducting magnet. Marty, J. (Grenoble-1 Univ., 38 (France)). Nov 1981. 194p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752048.

This work is mainly concerned with 20 Tesla induction production study. This magnetic induction should be produced by associating a series of coils using high critical field commercial: superconductors to the 10 Tesla magnet (diameter: 300; let's call it 10-300 magnet). The operation temperature lowering from 4,2° K to 1,8° K should effectively lead to much higher inductions (with equal effective diameter) than the greatest performances nowadays realized at 4,2°K temperature. To this performance augmentation is associated a more important energy density augmentation. This leads to the necessity of the knowledge of the superconducting material physical properties. They are studied in this report. Following, different methodes of magnet calculations are described: problems related to mechanical constraints, protection and stability must be known. Finally, some coils of the 10-300 magnet are presented together with their realization.

44859 (KFK—3518) Field enhancement by magnetic flux concentration. Schauer, W.; Arendt, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik). Jun 1983. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751899.

Short sample measurements in high magnetic fields are necessary to determine the critical current density and the upper critical field of superconducting materials. To perform these investigations a superconducting solenoid composed of Nb_3Sn tape wound pancakes (Intermagnetics General Co.) is used in the KfK Institut fuer Technische Physik, which produces a field of 13 Tesla in a 65 mm bore. Holmium and Terbium flux concentrators are mounted in the bore to increase the central field by ferromagnetic flux concentration. This leads to an enhanced field of 16 Tesla in the gap. The report summarizes aspects concerning the relevant data of the ferromagnetic material, experimental results and calculations of the field enhancement by ferromagnetic flux concentration.

44860 (LA-UR—85-2194) Innovations in Los Alamos alpha box design. Ledbetter, J.M.; Dowler, K.E.; Cook, J.H. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-851115—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014088.

From American Nuclear Society winter meeting; San Francisco, CA, USA (10 Nov 1985).

Destructive examinations of irradiated fuel pins containing plutonium fuel must be performed in shielded hot cells with strict provisions for containing the plutonium. Alpha boxes provide containment for the plutonium, toxic fission products, and other hazardous highly radioactive materials. The alpha box contains windows for viewing and a variety of transfer systems specially designed to allow transfers in and out of the alpha box without spread of the hazardous materials that are contained in the box. Alpha boxes have been in use in the Wing 9 hot cells at Los Alamos National Laboratory for more than 20 years. Features of the newly designed alpha boxes are presented.

44861 (LCC—016/84) Vortex induced vibrations in gapped restrainted pipes. Veloso, P.deA.A.; Loula, A.F.D. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). 1984. 23p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701981.

The vortex induced vibration problem of gapped restrained piping is solved numerically. The model proposed by Skop-Griffin is used to describe the pipe-fluid interaction. The variational formulation is obtained modeling the gapped restraints as non-linear elastic springs. The regularized problem is solved using a finite element discretization for the spatial domain. In the time domain a finite difference discretization is used for the lift coefficient equation and a Newmark discretization for the equation of motion.

44862 (NAC-AR—83-01, pp 168-179) Electrical engineering. 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

During the past year the Electrical Engineering Section has worked among others on the following projects: a vacuum control and interlocking system; the specification and ordering of current-stabilised power supplies; high-voltage power supplies; switching-mode power suppies for stepping-motor break controllers; a CAMAC interface for the emittance measurement system; a temperature measurement and alarm system and a stepping-motor driver.

44863 (NAC-AR—83-01, pp 155-167) **Mechanical engineering.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

The manufacturing of the following is discussed: ion sources, resonators, short-circuit plates, probes, capacitors, transfer beamline supports, magnets and the installation of the final cyclotron cooling system.

44864 **(PB—85-201804) Recent developments in self-contained cryocoolers for SQUIDS and other low-power cryoelectronic devices. Final report.** Zimmerman, J.E. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). 1984. 7p. Proceedings of Int. Cryogenic Engineering Conference (10th), Helsinki, Finland, July 31-August 3, 1984, p13-19.

The particular requirements of refrigeration for very-low-power cryoelectronic devices have been addressed only during the last few years. A number of laboratory prototypes are now near realization, and commercial systems may be available soon. These include Stirling and Gifford-McMahon machines and a four-stage Joule-Thomson machine, or a combination of one of the former with a final Joule-Thomson stage to achieve 4K, and small liquid-helium cryostats with integral intermittent reliquefying capability. The most-difficult technical problem outstanding is to design reliable, non-contaminating, miniature compressors for these machines.

44865 **(PNL-SA—12634) Simplified model for computing pipe-to-pipe impact response.** Friley, J.R. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 7p. (CONF-850670—23). NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number TI85016279.

From ASME Pressure Vessel and Piping Division conference; New Orleans, LA, USA (24 Jun 1985).

A simplified method has been devised to assess the responses of pipe to pipe impact events for a limited set of conditions. The impacted pipe is required to be straight, simply supported, fluid filled and struck at its mid span. The impacting pipe is required to be straight and pivoted about a fixed end. Plastic hinge locations are limited to the points of contact. The pipes are assumed to remain in contact and not rebound. Thus all of the initial kinetic energy is assumed to be dissipated either by local pipe crushing or by plastic hinge motion. The model shows reasonable agreement with experimental results.

44866 **(SAND—84-1472) Current CIM activities in the materials process engineering and fabrication directorate 7400.** Plomp, P. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1985. Contract AC04-76DP00789. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015491.

The Sandia Process Engineering and Fabrication (P/F) Directorate, 7400, is steadily procuring and installing computer controlled manufacturing and inspection equipment. To program this equipment effectively and to take maximum advantage of the Sandia engineering design database, a network of VAX computers and a set of high performance color graphics terminals are proposed. This report briefly explains this program.

44867 **(UCID—19323-84-3) Engineering research progress report, FY84.** Adye, P.; Bruner, J.M.; Denney, R.M.; Kamelgarn, M.B. (eds.). (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85015969.

The Engineering Research Program in the Mechanical Engineering Department, guided by Associate Director for Engineering H.C. McDonald, seeks new knowledge for mechanical-engineering applications of immediate or potential interest to the Laboratory. In FY84, the Program supported 10 projects with a budget of $1,622,000. These projects enhanced the mechanical-engineering technology base in four thrust areas which are strongly related: (1) Surface Measurements and Characterization (1 project); (2) Fabrication Technology (2 projects); (3) Materials Characterization and Behavior (5 projects); (4) Computer-Aided Engineering (2 projects). This progress report presents the activities pursued by members of the Program during FY84. It emphasizes work done in the second half of the year and gives an overview of the accomplishments of the first half. Readers who want a detailed account of work done during the first half of the year are directed to an earlier report (Engineering Research Progress Report, October 1983-March 1984, UCID-19323-84-2). The Engineering Research Program attaches great importance to information exchange and technology transfer with technical communities both inside and outside the Laboratory. Readers desiring more information on the activities reported here are encouraged to contact the authors.

44868 (UCID—19323-84-3, pp 19-29) **Chip science: research on single-point machining.** Donaldson, R.R.; Vandervoort, R.R.; Mara, G.L.; Landingham, R.L. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Machining to high accuracy has been a long-standing interest of Laboratory programs. Over the past two decades, major gains in accuracy have been made through improvements in machine tools, especially those used for diamond turning. Machine-tool accuracy has now been improved to the point where performance of the diamond-tool tip is becoming a limiting factor. Further progress thus requires a more basic understanding of the material-removal process at the tip of a cutting tool, a field we call "chip science". This knowledge would allow greater accuracy in diamond turning and also in the larger realm of cutting nondiamond-turnable materials such as ferrous metals. During FY84, we developed an interdisciplinary team and assembled the research hardware to do several exploratory experiments. These included tests on beryllium and molybdenum with specially prepared sharp-edged tools. The results showed excellent form accuracy and low tool-edge wear but surface-finish defects due to "grain-pullout" subsurface fracture of the workpiece material. We also began a more extensive study of the diamond turning of electroless nickel, an attractive material which has shown inconsistent surface finish and tool wear in the past. Much insight was gained by applying materials-science characterization techniques to the cutting tests. In addition, we began analytical modeling with the code NIKE2D in conjunction with North Carolina State University. Modeling should aid in predicting stress and deformation fields as a function of tool-edge radius and other parameters.

44869 (UCID—19323-84-3, pp 84-93) **Multivariable systems analysis and design.** Pimentel, K.D. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Complex multivariable systems that combine mechanical structures with electromechanical sensors, actuators, and control systems are often used for programs at and outside the Laboratory. As part of a joint project with the Electronics Engineering Department, we provide computer tools to simulate, analyze, and design these multivariable systems for the programs. We have carried out research at the interface between modern control-system theory on the electronics side, and reduced-order modeling of structures on the mechanical side. The interaction between structures and control is emerging as a core research area for future systems work planned for the Laboratory and outside agencies. Also during this reporting period, we applied the results of our computer-tools development to weapons platform feasibility studies in directed-energy weapons programs at the Laboratory.

44870 (UCID—20473-Rev.1) ELF-VLF Communications through the Earth Project report for calendar year 1984. Revision 1. Buettner, H.M.; Burke, G.J.; Didwall, E.M.; Holladay, G.; Lytle, R.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017319.

We use computer models and experiments to explore the feasibility of communication between points underground and on the Earth's surface. Emphasis is placed on ELF-VLF electromagnetic propagation through the Earth; nominally, we investigated propagation in the 200 Hz-30 kHz frequency range. The computer modeling included calculations of the fields of a point electric or magnetic source in a homogeneous half space or a stratified earth. Initial results for an insulated antenna of finite length are also considered. The experiments involved through-the-earth transmissions at two locations in Pennsylvania, both of which had large formations of limestone. Initial results indicate that information rates as high as kbits/s may be possible for subsurface depths of 300 m or less. Accuracy of these estimates depends on the electromagnetic propagation constant of the rock, the noise characteristics, and the modulation scheme. Although a nuisance for evaluating through-the-Earth propagation, the existence of subsurface metal conductors can improve the transmission character of the site.

44871 (UCID—20494) Data acquisition with real-time plots. Koide, G. (Lawrence Livermore National Lab., CA (USA)). 09 Aug 1985. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017326.

A data acquisition system using an LSI-11/23 microcomputer has 32 analog-to-digital channels of which the first four are available for real-time plots. The software is menu driven allowing a user to easily step through an experimental test. To calibrate each transducer, one of three options must be selected. They are shunt calibration, calibration with known inputs, and manually entering the offset and scale factor directly. After a test, post-experimental plots may be made. Any channel can be plotted against time or any other channel. Furthermore, more than one curve, up to a maximum of four, can be drawn on any set of grids. Telescopic views of any portion of data are also possible.

44872 Nuclear quadrupole resonance detected at 30 MHz with a dc superconducting quantum interference device. Hilbert, C.; Clarke, J.; Sleator, T.; Hahn, E.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Applied Physics Letters;* **47**: No. 6, 637-639(15 Sep 1985). Contract AC03-76SF00098.

A dc superconducting quantum interference device is used as a tuned radio frequency amplifier at liquid helium temperatures to detect pulsed nuclear quadrupole resonance at ~30 MHz. At a bath temperature of 4.2 K, a total system noise temperature of 6 +- 1 K has been achieved, with a quality factor Q of 2500. A novel Q spoiler, consisting of a series array of Josephson tunnel junctions, reduces the ring-down time of the tuned circuit after each pulse. The minimum number of Bohr magnetons observable from a free precession signal after a single pulse is $\sim 2 \times 10^{16}$ in a bandwidth of 10 kHz.

44873 Ultrahigh-vacuum cryostat and sample manipulator for operation between 5 and 800 K. Shayegan, M.; Cavallo, J.M.; Chottiner, G.; Glover R.E. III. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Review of Scientific Instruments;* **56**: No. 9, 1799-1803(Sep 1985). Contract FG05-84ER45071.

Design and performance of a cryostat with a rotatable sample stage for operation in ultrahigh vacuum is reported. The cryostat, which is designed for adsorption studies on single-crystal metals at low temperatures, has a temperature range of 5.5< or =T< or =800 K. Sample cooling from 800 to 5.5 K is achieved in about 90 min.

44874 Device for handling cesium safely. Pepmiller, P.L.; Loftus, J.M. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **56**: No. 9, 1832-1833(Sep 1985). Contract AC05-84OR21400.

A simple device has been designed and built to protect, warm, open, and dispense cesium (Cs) contained in glass vials. The device provides the user a larger margin of safety than most other commonly used methods, while being inexpensive and simple to operate.

44875 Development of high performance superconductors by powder metallurgy. Foner, S. (Massachusetts Institute of Technology, Cambridge). *Progress in Powder Metallurgy;* **38**: 107-114(1983). (CONF-8205171—).

From National powder metallurgy conference; Montreal, Canada (24 May 1982).

Powder metallurgy processing has been developed as an alternate process for fabrication of ultrafine fiber, high performance superconducting wires. A brief summary of the fabrication, performance and the unique characteristics of these high performance superconductors is given with an extensive list of references. The essential ingredients for powder metallurgy processed Nb_3Sn and Nb_3Al are the commercially available starting powders. Desirable characteristics of commercial powders for ultrafine fiber processing are indicated.

44876 (CE-Trans—8018) New fire barrier systems for cables and pipes. Bittner, H. Translated from *VGB Kraftwerkstechnik ;* **62**: No. 11, 949-955(Nov 1982). 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901981.

The special demands made of plant technology in power stations result in the necessity of a large number of cable and pipe routes which necessarily pass through several buildings (fire sections) and over several levels within these buildings, to which fire protection requirements are applied by the building regulations. After a short survey of the existing situation regarding regulations, therefore, this paper deals from a present-day perspective with the specific power station fire protection requirements to be applied in cable and pipe systems in conventional power stations and nuclear power stations, and describes the basic design of barrier systems for cables and pipes. Particular attention is given to pipe barrier systems and their new design variants which have already been partly tested.

4203 Lasers

REFER ALSO TO CITATION(S) 44863, 44928, 44995, 45850, 45851, 45861

44877 (DOE/ER/13272—001) Joint University of Maryland-Massachusetts Institute of Technology research on millimeter wave radiation from rotating electron beams in rippled magnetic fields. Progress report. Destler, W.W.; Bekefi, G. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). Apr 1985. Contract FG05-84ER13272. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016808.

Research on the millimeter waves produced by rotating electron beams in rippled magnetic fields has been pursued under Department of Energy sponsorship since July 1, 1984. This research is being conducted as a collaborative effort between researchers at the University of Maryland and the Massachusetts Institute of Technology. In this regard, the University of Maryland is the prime contractor and the Massachusetts Institute of Technology is the subcontractor, although actual research responsibilities and expenditures are shared about equally between the two groups. The goals of this research program is to investigate the production of millimeter and submillimeter radiation by the interaction of a rotating electron beam with a rippled magnetic field. The device is most easily described as a circular geometry free electron laser (FEL), in which the rotating beam interacts with a periodic wiggler field produced by samarium cobalt magnets placed interior and exterior to the beam. The potential advantages of such a device include: (1) a more compact configuration than that of a linear FEL; (2) a contin-

uous recirculation of the beam electrons through the wiggler field, thus providing a longer effective wiggler region; and (3) internal feedback resulting from the recirculation of the electromagnetic wave. This last feature may mean that the device can operate as an oscillator rather than an amplifier, as in the case of linear FEL's.

44878 (LA-UR—85-2380) Long-base free electron laser resonant cavity. Miller, E.L.; Bender, S.C.; Appert, Q.D.; Saxman, A.C.; Swann, T.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-850345—31). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015668.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

A 65-meter resonant cavity has been constructed in order to experimentally determine the characteristics of long resonant cavities as would be required for a free electron laser (FEL). A version using normal incidence mirrors is reported here, and another that includes a grazing incidence mirror is forthcoming. Either version is designed to simulate a FEL operating at 0.5 micron wavelength and is near-concentric with a stability parameter of 0.98. Argon-ion plasma tubes simulate the laser gain that would be provided by a wiggler in an actual FEL. The cavity was constructed on a seismic slab and air turbulence effects were reduced by surrounding the beam with helium in 6 in. diameter tubes. Alignment sensitivities are reported and compared to geometrical and diffraction predictions with good agreement.

44879 (PB—85-202802) Calorimeter for measuring 1-15 kJ laser pulses. Final report. Simpson, P.A.; Johnson, E.G. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). 1984. 4p. Proceedings of SPIE - Optical Radiation Measurements, San Diego, CA., August 21-22 1984, p121-124.

Two calorimeters for measuring high peak power laser pulses were constructed by the NBS and delivered to the Newark Air Force Station, Newark, Ohio. These calorimeters are designed to measure pulses having intensities great enough to damage the volume-absorbing material in normal calorimeters. In these new calorimeters, the volume absorbing material is already fragmented and flowing dry N_2 gas is used to extract the temperature-rise information. Pulse energy can be in the range 1 to 15 kJ. Wavelength range is from the ir to uv by employing various volume-absorbing materials.

44880 Lasing transitions in GaAs/GaAs/sub 1-x/P/sub x/ strained-layer superlattices with x = 0.1—0.5. Gourley, P.L.; Hohimer, J.P.; Biefeld, R.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **47**: No. 6, 552-554(15 Sep 1985). Contract AC04-76DP00789.

The role of strain in modifying lasing transition energy and gain coefficient in photopumped GaAs/GaAs/sub 1-x/P/sub x/ strained-layer superlattices is investigated by examining photoluminescence, excitation, and lasing spectra for samples with x in the range 0.1—0.5. Over this range, the lasing transition energy increases 50 meV, independent of quantum size effects. The compressive biaxial strain present in the GaAs layers is expected to significantly increase the gain coefficient for the '3/2, +- 1/2> "light" hole transitions. However, polarization measurements of the lasing spectra show no evidence for lasing on the TM mode '3/2, +- 1/2> transitions and show lasing only on the TE mode '3/2, +- 3/2> "heavy" hole transitions.

44881 Small-period electromagnet wigglers for free-electron lasers. Granatstein, V.L.; Destler, W.W.; Mayergoyz, I.D. (Electrical Engineering Department, University of Maryland, College Park, Maryland 20742). *Applied Physics Letters;* **47**: No. 6, 643-645(15 Sep 1985).

A new configuration for wiggler magnets compatible with free-electron laser (FEL) deployment is described and demonstrated experimentally. The configuration is simple and inexpensive to fabricate and allows for continuous control of magnetic field amplitude. Because ferromagnetic cores are used, the wiggler fields are strong (~0.1 T), while the wiggler period can be very small, on the order of 1 mm. It is shown that high power millimeter and submillimeter FEL's could be built using such wigglers together with sheet electron beams, and that they would have substantially reduced electron energy requirements when compared with FEL's employing larger period wigglers.

44882 Wiggle plane focusing in linear wigglers. Scharlemann, E. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *Journal of Applied Physics;* **58**: No. 6, 2154-2161(15 Sep 1985).

In a free-electron laser with a long, linear wiggler, the external focusing required to keep the electron beam from dispersing can seriously degrade the performance of the laser. The transverse focusing modulates the longitudinal velocity of each electron, periodically and nonadiabatically changing the phase of the electron with respect to the electromagnetic wave. Phase changes of order unity over a betatron period can strongly detrap or debunch electrons and greatly reduce the gain of a linear wiggler amplifier. The modulation of the electron's longitudinal velocity can be prevented if focusing in the plane of the electron's wiggle motion is provided by parabolically curved magnet pole faces. The focusing and resonance effects of curved pole faces are analytically calculated and numerically confirmed. Numerical simulations of linear wiggler amplifiers are presented to illustrate the effect of the curved pole faces on amplifier performance.

44883 Optically pumped laser system having extracavity pulse smoother. Trebino, F.P. US Patent Application 6,721,833. 11 Apr 1985. 14p. NTIS, PC A02/MF A01.

A laser system includes a pulse-smoother device positioned outside the laser cavity and in the path of the laser-pump beam. A highly reflecting mirror and a partially reflecting mirror receive the pumping beam, which has the temporal intensity fluctuations. Upon impinging on the partially reflecting mirror, some of the beam passes through to a lens. Other parts of the beam are reflected back onto the highly reflecting mirror which in turn, reflects the light back onto the partially reflecting mirror. This process is repeated throughout the lengths of the mirrors and the light exiting the beam-smoothing device is combined. That is, the delayed and undelayed beams are added in the lens and focused upon the laser-gain medium, providing a composite beam of light with reduced fluctations. This process has the effect that the pumped laser output beam has a smoother output.

44884 Analog frequency modulated laser using magnetostriction. Kabacoff, L.T. US Patent Application 6,715,786. 25 Mar 1985. 20p. NTIS, PC A02/MF A01.

The present invention relates to an analog frequency modulatable laser. The radiation of the lasing medium is analog frequency modulated by change of the optical path length by movement of reflective mirrors forming the resonant cavity at the frequency of radiation of the laser in a manner corresponding to an information signal. In one embodiment, a magnetostricitive material is deposited on and bonded to the outer periphery of an active lasing medium having appropriate mirrors on the ends thereof. The magnetostrictive material is exposed to an information-encoded magnetic field and physically expands or contracts the physical length of the lasing medium along the optical axis of the lasing medium corresponding to the modulated information of the magnetic field. In another embodiment, an optical fiber is secured by cementing or clamping to a transparent end of the active lasing material and one of the optical cavity reflecting mirrors is disposed on the outside end of the optical fiber with the magnetostrictive material being disposed on the optical fiber.

44885 (UCRL-Trans—12068) Correlation between the possibility of laser action and the oscillator strength of the fluorescent transition: pyrylium salts. Rulliere, C.; Declemy, A.; Balaban, A.T. Translated from *Canadian Journal of Physics ;* **63**: 191(1985). Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015185.

Laser action is demonstrated to occur in seven pyrylium salts between 4100 and 5100 A with quantum yields extending from 4% to 12%. Theoretical calculations of the energy and oscillator strength of S/sub O/→S/sub n/ transitions confirm band assign-

ments deduced from experimental results. These results allow detection of a weak hidden transition in the 2,6-dimethyl-4-phenyl-pyrylium cation where laser action is not observed. This shows how important the magnitude of the oscillator strength of the first transition S/sub O/→S/sub 1/ is in selecting candidates to laser action.

44886 **Coupling efficiency of waveguide laser resonators formed by flat mirrors: analysis and experiment.** Gerlach, R.; Wei, D.; Amer, N.M. (Univ. of California, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-20**: No. 8, 948-963(Aug 1984). Contract AC03-76SF00098.

A new and more efficient method of calculating the losses of a waveguide and flat mirrors, taking into account the effects of waveguide modes up to order HE_{13} is presented. Both symmetric and asymmetric cavities are considered. It is shown that low cavity losses, only slightly exceeding the HE_{11} waveguiding losses, are predicted to be possible for much larger mirror distances than had previously been suspected, provided that an optimum total cavity length is chosen. The low losses arise when the HE_{11} and HE_{12} modes emerge from the guide with relative amplitudes and phases such that the returning diffraction patterns interfere to produce a narrow beam with low aperture losses. The theoretical predictions were checked experimentally for CO_2 lasers having various waveguide dimensions. Good qualitative agreement was found, but the optimum total cavity lengths were typically 3-5% longer than predicted. Possible explanations of this discrepancy are discussed.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 44270, 44365, 45039

44887 **(AD-A—154551/6/XAB) Benefits of spirally enhanced tubes for steam condensers in minimum-weight cooling systems. Final report.** Knauss, D.T.; Kornbau, R.W. (Naval Ship Research and Development Center, Annapolis, MD (USA)). Oct 1984. 79p. (DTNSRDC/PAS—83/42). NTIS, PC A05/MF A01.

A design study determined the weight and volume benefits of heat-transfer augmentation in large steam-condenser cooling systems. By using an advanced Navy computer model and the observed dependence of system performance on coolant flow rate, flow-optimized designs for minimum system size or weight could be found for any given enhancement. The analysis, conducted for a given steam flow, assesses the effects of tube geometry, overall condenser length, and design constraints relating to waterbox diameter and condenser vacuum. The systems incorporate new high-strength, lightweight materials (titanium and Inconel) and include a main condenser consisting of titanium tubes having a 5/8-in. o.d. and 0.035-in. wall. General coolant-pumping-power correlations are developed for the spirally enhanced geometries examined. Results for two enhanced-tube geometries indicate that condenser-tube enhancement can provide system weight reductions ranging from 20 to 5% for short and long condensers, respectively.

44888 **(AECL—8065) Method of predicting pressure profiles in horizontal 37-element clusters.** Snoek, C.W.; Ahmad, S.Y. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 28p. (CONF-830439—12). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701975.

From 3. multi-phase flow and heat transfer symposium; Miami, FL, USA (18 Apr 1983).

A new two-phase friction multiplier correlation has been developed to predict the pressure profile in two-phase flow with heat addition. The main difference from other pressure drop prediction routines is that in addition to the effect of quality, the effects of system pressure, heat and mass flux on the two-phase multiplier are included. The inception of two-phase flow is defined to occur at the onset of significant void in the subcooled boiling regime instead of the boundary between negative and positive thermodynamic equilibrium quality. Pressure drop data from an experiment with a fully segmented 6-metre long, 37-element fuel string were used to optimize the constants and exponents of this correlation for the friction multiplier. This pressure drop prediction technique was shown to successfully predict the measured pressure profiles. The more than one hundred overall pressure drop data were predicted with an RMS error of 5.4 percent. The pressure drop measured during experiments with geometrically different simulated fuel strings and different operating conditions were also successfully predicted. The paper presents the derivation of the equations in a systematic manner. The effects of the system parameters on the prediction error are discussed in detail.

44889 **(AECL—8185) Moving boundaries in heat conduction and mass diffusion problems.** Duncan, D.B. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701976.

A brief introduction to the mathematical study of moving boundaries in heat-conduction and mass-diffusion problems is presented. A list of references is given for further investigation of the analytical and numerical methods mentioned in the text.

44890 **(AECL—8271) Predicted and measured velocity distribution in a model heat exchanger.** Rhodes, D.B.; Carlucci, L.N. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1984. 19p. (CONF-830932—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701977.

From International conference on numerical methods in nuclear engineering; Montreal, Canada (6 Sep 1983).

This paper presents a comparison between numerical predictions, using the porous media concept, and measurements of the two-dimensional isothermal shell-side velocity distributions in a model heat exchanger. Computations and measurements were done with and without tubes present in the model. The effect of tube-to-baffle leakage was also investigated. The comparison was made to validate certain porous media concepts used in a computer code being developed to predict the detailed shell-side flow in a wide range of shell-and-tube heat exchanger geometries.

44891 **(AECL—8272) Brief review of tube fretting-wear in heat exchangers.** Ko, P.L. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701978.

Fretting-wear damage in heat exchangers is caused by the relative motion of vibrating tubes against the walls of tube-support holes. Understanding the effects of various parameters on wear will help designers minimize or avoid such damages. This report describes the mechanisms for tube fretting-wear, as well as the sensitivity of wear rate to various system parameters.

44892 **(AECL—8350) Computer-aided tube fretting-wear predictions.** Ko, P.L. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1984. 23p. (CONF-830932—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701979.

From International conference on numerical methods in nuclear engineering; Montreal, Canada (6 Sep 1983).

Tube fretting in heat exchangers is the result of flow-induced tube vibrations, and consequently, fretting-wear predictions are required to determine the long term reliability of this equipment. The first step is to predict the impact forces between the tube supports and the vibrating multi-span tubes. A computer model, called VIBIC, has been developed to do this. The next step is to establish experimental force-wear relationships for different tube/support material combinations. This includes the development of a technique to statistically analyse the support impact forces, to account for the different types of tube motion. VIBIC can now simulate a vibrating tube to obtain the statistical force functions. It then uses these forcing functions and experimentally derived wear-force curves to predict wear rate. Examples are given to illustrate the wear prediction technique and other applications are suggested.

44893 (ANL—85-40) Heat exchanger vibration analysis (HXVA) for prediction of tube bundle instabilities. Mulcahy, T.M.; Wambsganss, M.W.; Yang, C.I. (Argonne National Lab., IL (USA)). May 1985. Contract W-31-109-ENG-38. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017144.

Pre and postprocessors have been written for an established hydraulic program (COMMIX-IHX) which enables prediction of the internal crossflow field for each tube of Argonne's Test Heat Exchanger and identification of those tubes most likely to experience fluidelastic instability, together with the instability vibration mode. While the direct use of the HXVA method is limited to single pass, single-segmentally baffled tube bundle configurations, its algorithms and methods can be applied to any type of heat exchanger which can be analyzed by COMMIX-IHX. The processors are explained and an example problem is given along with comparisons of experimental results.

44894 (CEA-R—5274) Stability of void fraction waves and bubble-slug transition. Matuszkiewicz, A.; Flamand, J.C.; Boure, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jul 1984. 97p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751201.

The propagation of natural void fraction disturbances in a nitrogen-water flow has been studied, through the statistical analysis of conductivity probe signals, for void fractions ranging from .1 to .5 and including the bubble slug transition. The power spectral density function and the standard deviation of the void fraction signal have been computed for each probe, as well as the phase factor (wave velocity), the coherence function and the gain factor between each pair of consecutive probes as a function of frequency. For bubble flows, the results are in agreement with the results obtained by other authors. The transition from bubble to slug flow is related to void fraction wave instabilities, two kinds of instabilities occurring simultaneously: amplitude increase (gain factor >1) and wave-breaking. A criterion for the flow-pattern transition between bubble and slug flow (maximum of standard deviation) is proposed.

44895 (CONF-850406—14) Particle-wall interaction and wall friction in gas-solid flows. Doss, E.D.; Srinivasan, M.G.; Raptis, A.C. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014984.

From International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society; Miami Beach, FL, USA (22 Apr 1985).

Analytical modeling based on one-dimensional two-phase flow for solid-gas suspensions in pipes is the objective of the work described here. The paper focuses on three different empirical correlations based on physical models available for expressing the effect of wall friction on the solid-gas suspension. The three correlations are described and comparisons are made for a typical case of pipe flow. Predictions of pressure drop and particle velocity based on the three models agree well with each other for certain values of empirical parameters. The actual choice of the approach will be made on the basis of experiments to be performed at the Argonne National Laboratory. 16 refs., 4 figs.

44896 (KFK—3813) Comparison between results obtained by different hot-wire methods. Rehme, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Dec 1984. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751903.

A fully automated rig enabled hot-wire measurements in a wall subchannel of a rod bundle by different hot-wire probes. Thus, not only a comparison of the results of different probes was possible but also of different evaluation methods. Probes with single wires and double wire probes were tested both with non-linearized and linearized output. The comparison between the results shows that measurements using a hot-wire probe with one straight wire and a probe with one slanting wire applied in five different orientations to the flow produced the most reliable results if the data are evaluated by the method proposed by Hooper.

44897 (KFK—3876) Investigations into the pressure drop and mass flow distribution of two-phase flow in rectangular T-junctions. Seeger, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Mar 1985. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752136.

The phase separation and pressure drop of a gas-liquid mixture flowing throuth a T-junction of equal pipe diameters (d = 50 mm) was investigated. The inlet pipe was orientated horizontally, the branch directions were horizontal and vertically upward or downward. The experiments were performed with air-water flow ($0.4 < p < 1$ MPa) and steam-water flow at pressures up to 10 MPa. The inlet mass flux and quality were varied in a wide range and included test parameters in the slug, annular and dispersed flow regimes. For constant inlet parameters the mass flux ratio G_3/G_1 between the inlet (1) and branch (3) was varied between 0 and 1. At the same time, detailed differential pressure drop measurements along the inlet, run and branch were carried out to determine the pressure drop in the T-junction. A comparison was made of different models describing the pressure difference Δpsub(1-3) between the inlet and branch and the pressure difference Δpsub(1-2) between the inlet and run on the one hand, and the experimental results, on the other hand. For the branch with upward orientation the T-junction acts as a good separator since nearly all of the gas flows through the branch. For the horizontal branch, the gas preferentially flows into the branch at high values of G_3/G_1.

4205 Materials Testing

REFER ALSO TO CITATION(S) 44235, 44261, 44418, 44610, 44688, 44694, 44867, 45016

44898 (AECL—8270) Eddy current inspection of mildly ferromagnetic tubing. Mayo, W.R.; Carter, J.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701945.

The past decade has seen the development of eddy current probes for inspection of the mildly ferro-magnetic alloy Monel 400. Due to the rapid advances in permanent magnet technology similar probes have been upgraded to magnetically saturate, and hence inspect, the duplex stainless steel Sandvik 3RE60, which has saturation induction more than twice that of Monel 400. Prototypes of these probes have been tested in three ways: saturation capability, quality of typical eddy current data, and ability to eliminate permeability induced signals. Successful laboratory testing, potential applications, and limitations of these type probes are discussed.

44899 (INIS-mf—9712, pp 128-132) Nondestructive testing of lining of reinforced concrete bridges. Hobst, L.; Svoboda, R. (Vysoke Uceni Technicke, Brno (Czechoslovakia)). Oct 1983. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781574. (CONF-8311258—Pt.1).

From Symposium on nondestructive testing in building '83; Tatranska Lomnica, Czechoslovakia (2 Nov 1983).

The distribution, course and profile of concrete reinforcement bars are found using a magnetic indicator or radiographically mostly using a ^{60}Co radioactive source with an activity of 370 GBq to 1.11 TBq. With simple girder bridges the lower tension reinforcement is controlled in the centre of the span, slide reinforcement near the support, reinforcement in the slab and possibly reinforcement in the foundation sill, with continuous girder bridges the upper tension reinforcement is determined using stereoscopic photographing from two foci. For wider girders the sources are placed in holes drilled in the girders at a distance of 200 mm. The magnetic indicator of reinforcement is used for controlling slab bridges of less reinforced concrete while the radiographic method is used for monitoring bridges with thicker reinforcement. The distribution of reinforcement in cross section is monitored graphically by plotting the configuration at which the cross section was scanned. (E.S.).

44900 **(Juel-Spez—277) Computer-guided facility for the study of single crystals at the gamma diffractometer GADI.** Heer, H.; Bleichert, H.; Gruhn, W.; Moeller, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentrallabor fuer Elektronik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Oct 1984. 74p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751876.

In the study of solid-state properties it is in many cases necessary to work with single crystals. The increased requirement in the industry and research as well as the desire for better characterization by means of γ-diffractometry made it necessary to improve and to modernize the existing instrument. The advantages of a computer-guided facility against the conventional, semiautomatic operation are manifold. Not only the process guidance, but also the data acquisition and evaluation are performed by the computer. By a remote control the operator is able to find quickly a reflex and to drive the crystal in every desired measuring position. The complete protocollation of all important measuring parameters, the convenient data storage, as well as the automatic evaluation are much useful for the user. Finally the measuring time can be increased to practically 24 hours per day. By this the versed characterization by means of γ-diffractometry is put on a completely new level.

44901 **(NUREG/CR—2294) Development of a standard test for measuring k/sub Ia/ with a modified compact specimen.** Crosley, P.B.; Ripling, E.J. (Materials Research Lab., Inc., Glenwood, IL (USA)). Aug 1981. Contract AC05-84OR21400. 112p. (ORNL/Sub—81/7755/1). NTIS, PC A06/MF A01. File Number TI85016021.

For an ASTM standard test method to have wide acceptance in the technical community, it must define the types of materials to which it is applicable, as well as defining the acceptable limits on a host of different test parameters. Further, for ASTM to evaluate the method, a Round Robin Test Program must be conducted as well. Work done over this contract period was concerned with each of these phases of writing a test method: tests were conducted to determine whether or not the test method could be extended to include the structural steels as well as the pressure vessel steels. The available K/sub Ia/ data were examined to see what testing parameter limits can be gleaned from the published literature, and steps were taken to initiate the Round Robin program.

44902 **(SAND—85-0568C) Description of a new 63-mm diameter gas gun facility.** Sheffield, S.A.; Dugan, D.W. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850736—54). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016131.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

This paper describes a new light gas gun that is just being completed at Sandia National Laboratories, primarily for use in the study of shock initiation and shock properties of explosive materials. This gun was patterned after the 100-mm diameter gas gun at Washington State University. Several unique features have been designed into the facility to make it easier to control and use the gun and to improve shot turnaround time. These are discussed in some detail and initial gun performance information is presented. 4 refs., 5 figs.

44903 (UCID—19323-84-3, pp 3-11) **Topometric interferometry.** Monjes, J.A.; Gillespie, C.H.; Edwards, D.F. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

The goal of this project is to characterize convex spherical surfaces with great resolution and accuracy by means of topometric interferometry. Our approach is an extension of the work of many others in the field of interferometric evaluation of surface quality. The method we use combines multiple-reflection interferometry and wavelength scanning. During the first half of FY84 we built a model to test our concept of a topometric interferometer. The model produced good measurements even though it lacked environmental controls and had a light source which could not be tuned. Obtaining better measurements requires environmental controls and a tunable, highly accurate light source. We dedicated the second half of FY84 to defining the proper light source and, in addition, to verifying the possibilities of the model. In FY85 we will build a prototype instrument with a suitable light source and environmental controls. We expect the prototype to produce interferograms of great resolution and accuracy, and we will use it to inspect and characterize demonstration parts.

44904 (UCID—19323-84-3, pp 30-39) **Flaw characterization by combining system identification and elastic wave scattering theory.** McKinney, R.L.; Clark, G.A.; Cook, B.D. (Houston Univ., TX). Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

The main goal of researchers in the Nondestructive Evaluation Section is to determine the size, shape, and orientation of flaws in materials. By combining system identification and elastic wave scattering theory, we might have the ability to size internal and surface cracks as well as describe lack of fusion in a weld root. We might also be able to assess the roughness, grain size, and residual stress of surfaces, which are important factors in fatigue and stress-corrosion-crack growth. Our ultrasonic procedures show promise for extracting more information on flaws than hitherto possible. We found that system identification significantly increases ultrasonic-signal resolution. We also found a close match between experimental results and calculation, which validates the theories used in this project. While our experimental results are favorable, we obtained them with well defined flaws, accurate calibrated equipment, and precise experiments; when such conditions are lacking, artifacts can occur. Signal preprocessing significantly reduces but does not eliminate the artifacts. We plan to apply several more sophisticated identification algorithms in an attempt to further reduce artifacts. In the course of our work we introduced the useful technology of waveform digitization to the Nondestructive Evaluation Section. We digitized the waveforms from the experiments performed on all three of our ultrasonic scanning systems: an acoustic microscope, a research scanner, and a large ultrasonic test bed.

44905 (UCID—19323-84-3, pp 50-54) **Study of conditions that control damage progression in fiber composites during repeated loading.** Hamstad, M.A.; Engle, R.B. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Stress-wave emission has been increasingly used by industry during proof testing to assess the quality and safety of chemical-process tanks made of glass-fiber-reinforced plastic (FRP). No other nondestructive-evaluation technique has been as successful as stress-wave emission. Because of the increasing use of fiber composites in LLNL projects, we need quality-assurance (QA) techniques. The long-range goal of the research reported here was to provide a framework for applying stress-wave techniques to the QA proof testing of fiber-composite materials of interest to LLNL. In order to apply these techniques to new composites and structures in as little development time as possible, we must understand damage mechanisms and the conditions that control them. We started with simple samples to identify and understand stress-wave detection for each damage mechanism, and planned to progress in complexity to specimens characteristic of real parts. The project has been terminated after one year of the originally planned three-year effort. Only elementary specimens were tested, and the analysis of data from the most recent tests is not complete. There are no plans at this time for future work. The capability to continue this approach is still available, and research could resume if interest develops within LLNL programs.

44906 (UCID—19323-84-3, pp 55-58) **Early characterization of graphite composites by fiber testing.** Wu, E.M. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

The increasing use of graphite composites in load-bearing structures has created a need for assessing and certifying composite structural reliability. Assessing reliability requires a large data base of information, and certifying reliability requires a methodology to screen materials. The goal of our project is to meet these needs by developing a fundamental understanding of the strength and life of a composite's constituent graphite fibers. We seek to predict long-

term composite life from short-term fiber-strength tests. We have developed improved methods of fiber-strength testing and analysis. The results of this research can now be considered for quality assurance of composite structural reliability in critical applications.

44907 (UCID—19323-84-3, pp 59-67) **Characterization of martensitic transformations using acoustic emission.** Tatro, C.A. Dec 1984. NTIS, PC A05/MF A01. File Number DE85015969.

In Engineering research progress report, FY84.

Acoustic emission (AE) is a highly sensitive technique which can reveal changes in materials not readily detectable by other means. It is nonintrusive, nondestructive, and capable of monitoring parts in a wide variety of shapes, sizes, and surface finishes. Our goal in this project was to obtain basic information on the AE response from martensitic transformation in steel. Such information was to permit us to study the feasibility of developing an AE-based quality assurance (QA) test for rough-cut component blanks and semifinished parts. We measured the AE response as a function of temperature in four steels undergoing martensitic transformation. We compared the martensitic start and finish temperatures (M/sub s/ and M/sub f/) obtained by AE with those measured by other methods and reported in the literature. M/sub s/ measured by AE was as much as 26°C higher than M/sub s/ reported for dilatometry. Furthermore, 10 to 30% of an alloy of Fe-0.2%C-27%Ni transformed to martensite during one burst. Our results show that AE can be used to study martensitic transformation both inside and outside the classical M/sub s/-M/sub f/ range. While our goal was not fully met because of early termination of the project, we did establish that AE is a sensitive tool for studying materials undergoing martensitic transformations. The AE response is sensitive to changes in material composition and heat treatment. The number of materials for which this QA technique is applicable was not determined; but assuredly, there are many more than we studied here. AE studies of martensitic transformation would be attractive from the basic materials-science point of view and could lead to new insights into this type of transformation process. This project and its predecessor also supported a small pilot study of stress-assisted and strain-induced martensitic transformation at the University of California, Davis. Details of that study will be reported later.

44908 **Measurement of small strains in a noisy environment.** Tillack, M.S.; Kazimi, M.S.; Lidsky, L.M. (Department of Nuclear Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* 56: No. 9, 1706-1711(Sep 1985). Contract AP07-79ID00019.

A simple technique is demonstrated for measuring strains in an electromagnetically noisy environment using electrical strain gauges. For applications in which strains are produced electromagnetically in current-carrying structures, the noise signal can be much larger than the strain signal. Furthermore, the noise signal is at precisely the same frequency as the strain signal, making standard methods of synchronous signal detection difficult. This problem has been surmounted by modulating the detection circuit sensitivity. Bridge circuit modulation has been shown to effectively decouple the strain signal from the noise, even at very low strain levels of $\sim 10^{-8}$ m/m.

4206 Safety Engineering

REFER ALSO TO CITATION(S) 44145, 44146, 44876, 45017, 45050

44909 **(PB—85-200962/XAB) Mine power system safety and reliability improvement. Part 1. Report for 28 September 1979-30 September 1981.** Hill, H.W.; Stanek, E.K. (West Virginia Univ., Morgantown (USA). Engineering Experiment Station). 30 Nov 1981. 188p. NTIS, PC A09/MF A01.

See also PB85-109288.

The report summarizes research into the root causes of failures in mine power systems that impact safety and reliability. Abnormally low-fault currents owing to arcing faults, self-excited systems, and fallen trolley wires are examined and quantified. The reliability of components that are critical for safety is studied, as well as reliability of components that are crucial to the mining process. Failure rates are found through in-situ tests, accelerated life tests, studies of mine maintenance, and fault-tree analysis. Reliability data are used to predict fatalities and lost-time accidents through computer-aided fault-tree analysis. Analytical support tasks reported include the determination of trailing-cable ampacities under cyclic loading and the measurements of connected ground beds.

44910 **(UCRL—93225) Earthquake safety program at Lawrence Livermore National Laboratory.** Freeland, G.E. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 11p. (CONF-8510118—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017400.

From DOE natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

Within three minutes on the morning of January 24, 1980, an earthquake and three aftershocks, with Richter magnitudes of 5.8, 5.1, 4.0, and 4.2., respectively, struck the Livermore Valley. Two days later, a Richter magnitude 5.4 earthquake occurred, which had its epicenter about 4 miles northwest of the Lawrence Livermore National Laboratory (LLNL). Although no one at the Lab was seriously injured, these earthquakes caused considerable damage and disruption. Masonry and concrete structures cracked and broke, trailers shifted and fell off their pedestals, office ceilings and overhead lighting fell, and bookcases overturned. We suddenly found ourselves immersed in a site-wide program of repairing earthquake-damaged facilities, and protecting our many employees and the surrounding community from future earthquakes. Over the past five years, LLNL has spent approximately $10 million on its earthquake restoration effort for repairs and upgrades. The discussion in this paper centers upon the earthquake damage that occurred, our clean-up and restoration efforts, the seismic review of LLNL facilities, our site-specific seismic design criteria, computer-floor upgrades, ceiling-system upgrades, unique building seismic upgrades, geologic and seismologic studies, and seismic instrumentation. 10 refs.

4207 Vacuum Engineering

44911 (EGG/10282—1057, pp 26.1-26.13) **Closed-loop cryogenic vacuum system for remote applications.** Kountanis, B.; Price, L.S. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A compact automated cryogenic vacuum pumping system configured in three modules for easy portability and featuring self-regeneration and remote-control capabilities is described. In addition to providing fast, clean pumping of gases in the range of 10^{-3} torr to 10^{-10} torr, the system has a self-contained buffer vacuum spool piece where experiments can be performed, or the system can be connected to any vacuum chamber. The vacuum chamber does not require vacuum gauging to operate the system, even from a remote location. A similar cryo-pumping system which allows remote-sensing operation of cryo pumps at distances of up to 2000 feet is currently being developed at SRO in coordination with LLNL scientists and engineers.

44912 **(KFK—3681-B) Vacuum system of the Karlsruhe magnetic spectrograph 'Little John'.** Buschmann, J.; Gils, H.J.; Jelitto, H.; Krisch, J.; Ludwig, G.; Manger, D.; Rebel, H.; Seith, W.; Zagromski, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Feb 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751894.

The vacuum equipment of the magnetic spectrograph Little John is described. The system is characterized by the following special features: The sliding exit flange of the target chamber can be moved to the desired angle of observation without affecting the high vacuum. The pressure maintained is less by a factor of ten than the pressure in the incoming beam tubing. The vacuum system is divided into several separate pumping sections. Ground loops are strictly avoided. All actual states of relevance are fed back to the

control panels. The vacuum installation is protected by hardware interlocking systems as well as by a real time program written in FORTRAN in cooperation with CAMAC interfacing.

44913 (LBL—19326) Automated system for measuring vacuum outgassing rates. Dormido, R.; Ghiorso, W.G.; Schalz, L.; Rosenblum, S.S. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 24p. NTIS, PC A02; 3; GPO Dep. File Number DE85016509.

Particle accelerators and particle physics detectors require large electrical insulators with metal embedments having vacuum on one side and an insulating fluid or gas on the other. For high vacuum requirements they may be fabricated out of sintered alumina using vacuum brazing to attach the metal pieces. Although this produces quite acceptable devices, it is very time-consuming and expensive, involving the pressing, firing and grinding-to-size of the alumina parts, the manufacture of a brazing fixture and the fabrication of the individual braze foils. After firing in a vacuum oven, if there are any vacuum leaks in the braze joints, the part usually must be rejected. For moderate vacuum service one can use cast or machined plastics which are glued together. Although this is a much less expensive fabrication method, the vacuum outgassing rates of these assemblies can be three orders of magnitude higher than the brazed alumina ones, which may be unacceptable for many applications. It was with these ideas in mind that the authors undertook a program at LBL to develop castable insulators using plastics filled with inorganic materials. The systems were selected mostly on the basis of manufacturer's data on the electrical and mechanical performance of the materials in electrical utility service. Very little data was available on vacuum outgassing. In the course of making the necessary vacuum outgassing measurements, it became clear that if data-taking were automated it could be easily done with a few hours labor per week per sample rather than about the 8 hours/sample required with manual data acquisition and analysis. The system that was developed is based on a Hewlett Packard HP-85 computer which controls the experiment and then evaluates the data and plots it. The measuring system uses the conductance of a fixed orifice and the readings of two Bayard-Alpert gauges to determine outgassing rates.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 45050

44914 (CAPE—2956) Luminoscope II circuit drawing (Engineering Materials). (Oak Ridge National Lab., TN (USA)). 5 Mar 1985. Contract AC05-84OR21400. 2 35-mm aperture cards H. File Number TI85016824.

The drawing to be copyrighted is identified as Drawing Number Q-6184-1 RO entitled "Circuit." The "Circuit" depicts the detector electronics portion of a portable luminoscope detector. The luminoscope detector is used to locate potentially carcinogenic materials in monitoring for occupational skin contamination.

44915 (ORNL/Sub—83-51926/2) Millimeter wave dielectric property measurement of gyrotron window materials. Technical report, January 26, 1983-October 31, 1984. Ho, W.W. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Apr 1985. Contract AC05-84OR21400. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016739.

The objectives of this program are to determine the millimeter-wave dielectric properties of various single crystal and ceramic materials and coolant fluids to provide the database for assessing their potentials and limitations in high power gyrotron window applications. Chemical and microstructural analyses are carried out on material systems showing the most promise for correlation of dielectric properties with material properties, and for establishing key processes and parameters controlling millimeter-wave absorption in support of advanced materials development efforts.

44916 Observation of adsorbate-induced surface states by elastic electron tunneling spectroscopy. LeDuc, H.G.; Lambe, J.; Thakoor, A.P.; Khanna, S.K. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109). *Journal of Applied Physics;* **58**: No. 6, 2266-2269(15 Sep 1985).

Electronic structure induced by adsorbates at the interface of Al/AlO/sub x//Au tunnel junctions has been observed by elastic electron tunneling spectroscopy. Strong structures appearing in the tunneling spectra above ~1 eV after exposure to I, Hg, Bi, and organohalides, have been interpreted in terms of adsorbate-induced surface states. The spectroscopic capabilities of elastic electron tunneling spectroscopy may be useful in the area of chemical detection. In the broader sense, the observation of adsorbate-induced unoccupied electronic states below the vacuum energy, makes elastic electron tunneling spectroscopy a potentially useful technique for the study of surfaces.

4209 Waste Processing Plants And Equipment

44917 (AD-A—154238/0/XAB) Linking R and D to problems experienced in solids processing. Merrow, E.W. (RAND Corp., Santa Monica, CA (USA)). Nov 1984. 22p. (RAND-P—7034). NTIS, PC A02/MF A01.

This paper reports the results of a 24-month Rand project that attempted to establish empirically the appropriate priorities for funding R and D for solids processing. This project grew out of a prior finding that plants, which process solids anywhere on the main process train, perform more poorly than plants that process only liquids and gases. This poor performance quite clearly costs the U.S. economy in general, and the process industries in particular, billions of dollars in lost revenue. Poor solids-processing plant performance also threatens the economic viability of synthetic fuels and a number of other energy processes based on solids processing technology.

44918 (CE-Trans—7502) Corrosion of heat exchanger tubes by flue gases containing HCl produced during the incineration of refuse. Grubitsch, H.; Hilbert, F.; Sammer, R. Translated from *Werkstoffe und Korrosion ;* **26**: No. 6, 449-454(1975). 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901858.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 43746, 44887, 44918

44919 (AD-A—154636/5/XAB) Structure of high-speed sprays. Final report, 1 July 1981-30 June 1984. Bracco, F.V. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). Feb 1985. 101p. NTIS, PC A06/MF A01.

The author measured and computed the drop size in the immediate vicinity of the nozzle in diesel-type sprays; measured and computed the drop velocities in the farfield of non vaporizing diesel-type sprays; measured (and is computing) the drop velocities in the farfield of vaporizing diesel-type sprays. The overall conclusions are that: the breakup of full-cone diesel jets is due primarily to aerodynamic interaction between the liquid surface and the chamber gas; the initial average size and velocity of the drops formed by the breakup of the outer surface of the jet can now be estimated and so can the length of the intact core but with greater uncertainty; after breakup, a steady full-cone spray undergoes a development similar to that of incompressible jets; in diesel engines it is the development region that is of importance; the major parameter in the difference between full cone sprays and incompressible jets is the liquid-to-gas density ratio; in the absence of vaporization, the most advanced of the available spray models reproduce full-cone sprays with adequate realism for applications; it is not yet known how vaporization changes the structure of these sprays and if available models adequately reproduce the changes. Several summary papers on the mechanism of atomization and on the structure of diesel sprays were produced.

44920 (PB—85-210979/XAB) High-temperature ceramic recuperator and combustion air burner programs. Final report, April 1981-October 1983. Strumpf, H.J.; Kotchick, D.M.; Coombs, M.G. (AiResearch Mfg. Co., Torrance, CA (USA)). Feb 1984. 575p. (REPT—84-20712). NTIS, PC A24/MF A01.

See also PB84-207844.

A study has been performed for the development of a ceramic recuperator and its companion high-temperature preheated combustion air burner. The system is designed to operate in a variety of industrial flue gas streams with exhaust temperatures up to 2500°F. The ceramic recuperator provides up to 2000°F preheated combustion air to the high-temperature burner. Under anticipated conditions, fuel savings of up to 50% are achieved when compared to unrecuperated furnaces. Current ceramic-recuperator and high-temperature burner systems were reviewed. Industrial processes with flue-gas temperatures in excess of 1900°F were identified and quantified to ascertain market potential. Conceptual designs of ceramic recuperators and burners were developed and evaluated for four promising industrial applications. A preliminary reference design of a high-temperature combustion air system was developed for a typical steel soaking-pit application. The design and fabrication of a 5-MMBtu/hr prototype recuperator was completed.

44921 (PB—85-220630/XAB) Pulsating burners - controlling mechanisms and performance. Annual report, December 1, 1983-November 30, 1984. Zinn, B.T.; Daniel, B.R.; Jagoda, J.I. (Georgia Inst. of Tech., Atlanta (USA). School of Aerospace Engineering). Mar 1985. 32p. NTIS, PC A03/MF A01.

Although gas-fired pulsed combustors for home heating have now been on the market for a number of years, little is known about the physical and chemical processes which control the operation of these devices. It is the objective of this study to gain an understanding of these processes such as mixing cycle to cycle reignition and flame propagation in the burner. Such an understanding would permit a more-rational approach towards the design of future combustors. Early tests have shown that the frequency of pulsations are a function of combustor volume and the combustor thus behaves as a Helmholtz resonator. Visual observations, high-speed shadow and Schlieren photography, and C-H and C-C measurements were carried out in a partially transparent combustor. Combustion was seen to occur largely in the mixing chamber. Fuel and air jets were seen to enter the mixing chamber, collide and mix. The new reactants are ignited by entrained radicals remaining from the previous cycle. Ignition takes place at the location and the time at which the two reactant streams first mix. The combustion then spreads with the flow throughout the mixing chamber in two opposing vortices. The reaction process never ceases at any time in the cycle.

44922 (CE-Trans—8047) Current state of knowledge on fire-side boiler fouling. Hein, K. Translated from *VGB Kraftwerkstechnik ;* **63**: No. 4, 350-356(1983). 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901982.

Following the introduction, the following topics are covered: (1) methods of investigation of boiler fouling; (2) deposit formation; (3) processes occurring in deposits; (4) remedial measures; and (5) recommendations for future investigations. 35 refs., 3 figs., 3 tabs.

44923 (BGC/MRS/M—14929) Entrainment in industrial type atmospheric burners. Douspis, M. (British Gas Corp., London; Gaz de France, 75 - Paris). [1985]. Translation source information not available . 66p. NTIS (US Sales Only), PC A04. File Number DE85902062.

The objective of this paper is to formulate a theoretical expression for air entrainment which is specific to industrial atmospheric induction burners. Following a theoretical study of this phenomenon, the results of which were checked out experimentally, the following were established: the air entrainment laws peculiar to industrial type atmospheric burners operating at high power and high pressure; a practical method of determining the modifications to be made to burners in the event of a change of gas; and a method of testing these burners which considerably simplifies determination of the air entrainment conditions. The impact of the air entrainment laws on burner operation was also investigated. 5 refs., 12 figs.

4220 Underground Engineering

44924 (BMFT-FB-T—85-061) Development of new mechanical and non-mechanical drilling processes for making blast holes in extremely hard or tough rock which is difficult to drill. Kulnig, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1985. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752694.

The research and development project carried out with the objective of developing high-speed economically efficient drilling technologies for making blast holes has shown that the conventional processes will not be inferior to alternative technologies in the foreseeable future. Hydraulic drilling is a fully developed process, but further progress is needed in the field of drill steels in order to still improve the economy of that process. In view of the present state of the art, thermal drilling methods are inadequate. Only in exceptional cases can such methods be used at a justifiable level of economic efficiency. Drilling with high-pressure water jet may become very important in future if it is combined with mechanical processes provided, however, an equilibrium of the energy balance can be reached. One possible solution seems to be the development going in the direction of lower water pressures and the use of additives.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 43658, 44176

44925 (NP—5752493) Testing of bag filter materials in coal-fueled plants. (Smidth (F.L.), Copenhagen (Denmark)). Feb 1985. vp. (In Danish). Smidth (F.L.), Copenhagen (Denmark).

EFP-81.

As part of the coal research program of the Danish Energy Department the filter installation at Skanderborg district heating fluid-bed boiler was selected as a trial installation for testing of bag filter materials. The trial period under review in this report stretched over 2 years, divided into two periods of operation, the winter period 82/83 and winter period 83/84, respectively. As concerns the last period of the trial which was commenced in November 84 report on results is to be submitted as an appendix to this report. During the trial period the filter load varied between 0.75 - 1.25 $m^3/m^2/min$ with a maximum pressure drop across the bags up to 165 mmWG. The exit gas temperature through the filter was at a fairly constant level of 145degC with a few short-term rises up to 200degC level. The exit gas and the filter dust showed no special signs of chemical aggressiveness, despite the fact that regular boiler shutdowns has brought the filter temperature through the acid - and water dewpoint on a number of occasions. However, the filter dust revealed, presumably due to the great number of boiler stop, a surprising tendency to be attracted to and on the filter bag, resulting in a remarkably large pressure drop with regard to the filter load rate. As it is, the operating conditions have not been as demanding as foreseen, and this involves that the cheapest bag quality used, the Nomex felt, has proved to be well suited for handling the dedusting task (author).

4250 Power Cycles

REFER ALSO TO CITATION(S) 44061

44926 (CONF-850808—19) Gamma Stirling configuration and simultaneous production of shaft power and heat pumping. Crowley, J.L.; Griffin, F.P.; West, C.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016314.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

In an ideal gamma configuration Stirling engine, the volume at the cold end of the displacer varies 180° out of phase with that at the hot end; therefore, exactly as much heat must be rejected as the hot end absorbs. The power piston, moving with a different phase, produces mechanical energy, so the power piston cylinder must absorb heat for there to be an overall energy balance. In other words, the engine simultaneously produces mechanical power and pumps heat between the two sections of the compression space. Inclusion of a second regenerator, between the cold displacer cylinder and the power piston cylinder, can capture this heat flow; the resulting machine is a heat-actuated heat pump that also produces shaft power. Unlike the duplex Stirling heat pump, the new configuration has only one working space and produces a surplus of shaft power.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 45004, 45442, 45468

44927 (AECL—7839) Characteristics of a thermal neutron source based on an intermediate energy proton accelerator. Lone, M.A.; Selander, W.N.; Townes, B.M.; Latouf, J.; Svensson, E.C.; Bartholomew, G.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701983.

The envisaged development program leading to a 1 GeV, 300 MW accelerator breeder pilot plant would require construction of three high-current proton test accelerators of progressively increasing energy. These accelerators would also be available to drive neutron sources for other applications. This report explores the characteristics of the high-intensity thermal neutron source that would be provided as part of the Electronuclear Materials Test Facility (EMTF), which is envisaged as a multi-purpose test system based on the accelerator of intermediate energy. Two options, a 300 mA cw proton beam at 100 MeV and a 70 mA cw proton beam at 200 MeV are considered. It is shown that the 70 mA, 200 MeV accelerator with a Pb-Bi eutectic target would provide an unperturbed peak thermal neutron flux of approximately 1.5×10^{15} $n.cm^{-2}.s^{-1}$ in a relatively large volume of a D_2O moderator. The 300 mA, 100 MeV accelerator with a Li target and graphite moderator would provide a peak thermal flux of approximately 6.0×10^{14} $n.cm^{-2}.s^{-1}$. Thermal neutron fluxes in various other moderators and heat limitations in various target configurations are also investigated.

44928 (CEA-R—5279) Free electron laser on the ACO storage ring. Elleaume, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-11 Univ., 91 - Orsay (France)). Jun 1984. 260p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85751215.

This dissertation presents the design and characteristics of a Free Electron Laser built on the electron storage ring ACO at Orsay. The weak optical gain available (approximately 0.1% per pass) necessitated the use of an optical klystron instead of an undulator and the use of mirror with extremely high reflectivity. The laser characteristics: spectra, micro and macro-temporal structures, transverse structure and power are presented. They are in very good agreement with a classical theory based on the Lorentz force and Maxwell equations.

44929 (CERN—84-13) Review of accelerator and particle physics at the CERN intersecting storage rings. Jacob, M.; Johnsen, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 30 Nov 1984. 87p. (CONF-840195—1). NTIS (US Sales Only), PC A05/MF A01. File Number DE85701932.

From Meeting of the Intersecting Storage Rings Committee (IRSC); Geneva, Switzerland (27 Jan 1984).

With 32 refs. .

The last meeting of the CERN Intersecting Storage Rings Committee (ISRC) was held on 27 January 1984, following the closing of the ISR for colliding-beam physics in December 1983. This report consists of the written versions of the two review talks presented at that meeting. K. Johnsen describes the history and importance of the ISR for accelerator physics, from the first ideas on colliding-beam devices to the final operation. M. Jacob gives his view of the role of the ISR physics programme in the development of particle physics up to and including the latest available results. The preface is by G. Bellettini, the last chairman of the ISR Committee.

44930 (CONF-830311—198) Compact pulsed accelerator. Rhee, M.J.; Schneider, R.F. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). 1983. Contract AS05-78ER05940. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015186.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The formation of fast pulses from a current charged transmission line and opening switch is described. By employing a plasma focus as an opening switch and diode in the prototype device, a proton beam of peak energy 250 keV is produced. The time integrated energy spectrum of the beam is constructed from a Thomson spectrograph. Applications of this device as an inexpensive and portable charged particle accelerator are discussed. 7 refs., 5 figs., 1 tab.

44931 (CONF-850470—8) Arc discharge conditioning test on the Oak Ridge 25 URC accelerator. Ziegler, N.F.; Stelson, P.H.; Jones, C.M. (Oak Ridge National Lab., TN (USA); National Electrostatics Corp., Middleton, WI (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016394.

From 4. international conference on electrostatic accelerator technology and associated boosters; Buenos Aires, Argentina (15 Apr 1985).

A hydrogen arc discharge has been run in the top five units (fifteen 20 cm tube sections) of the ORNL tandem accelerator to test the effectiveness of this method of cleaning the high voltage electrodes. The discharge was maintained in both the high- and low-energy tubes for a period of six hours. The arc current in each tube was 4.0 A and the hydrogen pressure was nominally 100 mTorr. The arc discharge does not appear to have significantly affected the operating voltage of the top five units of the accelerator. However, the voltage conditioning behavior of the tested units is markedly different.

44932 (GANIL-A—84-01) Space charge and high intensity effects in radiofrequency linacs. Lapostolle, P. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). Feb 1984. 27p. (CONF-840158—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751183.

From INS winter school on accelerators for nuclear physics; Kikuchi, Japan (29 Jan 1984).

High intensity R.F. linacs are considered for various projects. Different problems are raised by those projects. Among theoretical problems is the computation of the maximum intensity a linac can accelerate, and the estimate of the loss of particules one is to expect. Another question is the estimate of possible deterioration of beam quality in particular its brightness. When the current circulating in a linac becomes high, large amount of electric charges are moving in the accelerating cavities and beam transport lines. These charges produce fields which several effects. Far fields are acting on the cavities. A short discussion of beam cavity interactions will be given in the last chapter. Near fields are acting on the particles themselves: "space charge" effect is a repulsion between charges. Instabilities on various types of bunch oscillations may also occur. The space charge field however mainly depends on the charge distribution of the particles in the bunches. In this lecture, linear problems will be developed first and another part will be devoted to a review of theoretical work and main results on non linear effects and instabilities as a guide to follow the progress which continues on the subject in different laboratories. Some description will then be made of computer simulation methods and eventually indications will be given on beam loading and beam cavity interactions.

44933 (LBL—19620) MBE-4, a heavy ion multiple-beam experiment. Avery, R.T.; Chavis, C.S.; Fessenden, T.J.; Gough, D.E.; Henderson, T.F.; Keefe, D.; Meneghetti, J.R.; Pike, C.D.; Vanecek, D.L.; Warwick, A.I. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—261). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016626.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

MBE-4, a heavy-ion multiple beam induction linac being built at LBL in FY85/86, will model many features of a much longer device. It will accelerate four space-charge-dominated cesium ion beams from, for example, 0.2 MeV, 5 mA/beam, 3.0 μsec, 1.6 m length at injection to ~0.8 MeV, 15 mA/beam, 1.0 μsec, 1.1 m length at the exit. It will permit study of simultaneous focussing, acceleration, current amplification and emittance growth of multiple space-charge-dominated ion beams. Some features of this accelerator are described. 11 refs., 5 figs.

44934 (SLAC-CN—306) Increasing the energy of SLC by transient wake field. Yao, C.G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 2 Jul 1985. Contract AC03-76SF00515. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015605.

Here the authors present a possible way to further increase the energy of SLAC single bunch from 50 GeV to 65 GeV or even more, without increasing the rf peak power and accelerator length.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 44966, 44968, 44969, 44970, 44994

44935 (AD-A—153583/0/XAB) Further studies of the NRL collective particle accelerator via numerical modeling with the MAGIC code. Final report, 1 April-30 September 1984. Barker, R.J. (Mission Research Corp., Alexandria, VA (USA)). Aug 1984. 99p. NTIS, PC A05/MF A01.

The 2-D electromagnetic, relativistic simulation code, MAGIC, was used to investigate the detailed physics associated with the operation of the NRL CPA testbed experiment. Code results contradicted the original conclusions drawn from the experimental diagnostics in that the central beam always propagated with a current of 1-2kA in the numerical simulations, while the experimental probes failed to detect that beam's presence in dual-beam mode of operation. Since 1-2kA was on the sensitivity threshold of their instruments used in the experiment, there is no reason to disbelieve the MAGIC results. This work argues in favor of a renewed CPA effect with improved diagnostics.

44936 (AECL—8053) Introduction to first order optics. Two lectures given to Scanditronix staff, May 1982. Davies, W.G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701985.

The fundamentals of ion optics are presented, beginning with the basic non-relativistic equations of motion, and the conditions under which the paraxial equations hold. The relativistically correct equations are then presented. The basic focussing properties of dipoles and quadrupoles are described as well as the operation of the quadrupole doublet and triplet. The matrix formulation of optics is developed and used to derive a number of basic results such as imaging relations, principal planes, dispersion and achromatism. The concepts of emittance, acceptance, brightness and phase space are introduced and illustrated by examples. A waist in phase space is defined, and its relationship to a focus is discussed. Both the 'Sigma matrix and Twiss formulations' for phase-space transformations are presented and their inter-relationship shown. Liouville's Theorem is also discussed along with conditions for its validity. Examples of the action of a lens and a drift space on the beam phase space are given to illustrate the power of these concepts and develop some familiarity with them on the part of the reader.

44937 (BNL—36779) Constructing and testing a demonstration Siberian Snake. Ratner, L.G. (Brookhaven National Lab., Upton, NY (USA)). [1985]. Contract AC02-76CH00016. 3p. (CONF-8506173—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016064.

From Workshop on polarized beams at the SSC; Ann Arbor, MI, USA (10 Jun 1985).

An outline of questions to be addressed on construction of a Siberian Snake is given including kinds of snakes and beam dynamics. (GHT)

44938 (BNL—36782) Summary of the working group on the construction and demonstration of a Siberian Snake. Ratner, L.G.; Raylman, R.R. (Brookhaven National Lab., Upton, NY (USA); Michigan Univ., Ann Arbor (USA). Randall Lab. of Physics). 1985. Contract AC02-76CH00016. 3p. (CONF-8506173—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016060.

From Workshop on polarized beams at the SSC; Ann Arbor, MI, USA (10 Jun 1985).

It was recognized as long ago as the 1977 Ann Arbor Meeting on Higher Energy Polarized Proton Beams that a "Siberian Snake" should be built and tested in an operating accelerator. A program to accomplish this at Argonne National Laboratory (ANL) was part of a proposal to DOE to construct a small R and D accelerator at ANL. This was never implemented and between then and now many theory papers have been written but no Proof of Principle Experiment (POPE) has been done. The present Ann Arbor workshop again strongly recommends that a POPE be implemented as soon as possible since it has important consequences for all of the new higher energy machines. This "Demo Snake" working group zeroed in on the Alternating Gradient Synchrotron (AGS) as the place where such a project could now be most effectively done. The AGS has a polarized beam and knowledgeable theoretical and experimental accelerator physicists who have been working with polarized beams in accelerators for the last few years. Referring to the information contained in the introductory remarks to the working group on the characteristics of snakes, we detail the necessary design for the AGS.

44939 (CERN—84-15) CERN accelerator school: Antiprotons for colliding beam facilities. Proceedings. Bryant, P.; Newman, S. (eds.). (European Organization for Nuclear Research, Geneva (Switzerland)). 20 Dec 1984. 562p. (CONF-831079—). NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982.

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

This is a specialized course which addresses a wide spectrum of theoretical and technological problems confronting the designer of an antiproton facility for high-energy-physics research. A broad and profound basis is provided by the lecturers' substantial experience gained over many years with CERN's unique equipment. Topics include beam optics, special lattices for antiproton accumulation and storage rings, antiproton production, stochastic cooling, acceleration and storage, R.F. noise, R.F. beam manipulations, beam-beam interaction, beam stability due to ion accumulation, and diagnostics. The SPS (Super Proton Synchrotron) p anti p collider, LEAR (the Low Energy Antiproton Ring at CERN), antiprotons in the ISR (Intersecting Storage Rings), the new antiproton collector (ACOL) and gas jet targets are also discussed. A table is included listing the parameters of all CERN's accelerators and storage rings. See hints under the relevant topics.

44940 (CERN—84-15, pp 9-32) **Introduction to beam optics.** Autin, B. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The purpose of beam optics is essentially the study of the transverse phase space which is the set of the coordinates of position and velocity of a particle in a plane normal to reference trajectories. The course is limited to the study of particle trajectories in a static magnetic field and to small amplitude oscillations. In addition, the oscillations are assumed to be uncoupled between the horizontal

and vertical directions. In the first part, elements of exact beam optics in a magnet and the transfer of a single particle are treated. In the second part, the concept of beam transfer is introduced with a review of Courant and Snyder theory of betatron oscillations. The last section is devoted to the local properties of the closed orbits when the momentum is varied in order to lay the basis for the study of the longitudinal phase space which is the set of the time and energy coordinates of a particle.

44941 (CERN—84-15, pp 97-161) **Stochastic cooling for beginners.** Moehl, D. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

These two lectures have been prepared to give a simple introduction to the principles. In Part I we try to explain stochastic cooling using the time-domain picture which starts from the pulse response of the system. In Part II the discussion is repeated, looking more closely at the frequency-domain response. An attempt is made to familiarize the beginners with some of the elementary cooling equations, from the 'single particle case' up to equations which describe the evolution of the particle distribution.

44942 (CERN—84-15, pp 215-260) **Theory of RF acceleration and RF noise.** Dome, G. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The author describes the theory of the acceleration of charged particles by electromagnetic fields. Especially he considers the influence of RF noise on the dynamics of the accelerated particle.

44943 (CERN—84-15, pp 319-367) **Beam-beam interaction.** Evans, L.R. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

Some experimental data on the beam-beam effect in e^+e^- and p-pbar colliders are presented in order to illustrate their differences and similarities. Then, after treating the linear beam-beam force, the subject of nonlinear resonances are introduced using some simple examples.

44944 **(CERN-EP—85-49) Status and perspectives of the electron cooling device under construction at CERN.** Habfast, C.; Poth, H.; Seligmann, B.; Haseroth, H.; Hill, C.E.; Vallet, J.L.; Wolf, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; European Organization for Nuclear Research, Geneva (Switzerland)). 15 Apr 1985. 6p. (CONF-850152—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901959.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The first electron cooling system for LEAR will cover the momentum range between 100 and 600 MeV/c. Recently, the assembly of a new vacuum system with modified electron gun and collector from the Initial Cooling Experiment (ICE) has been finished. In the present configuration, gun and collector allow for cooling antiprotons at momenta up to 370 MeV/c. A new gun and collector for the higher momenta are being designed. After separate tests in 1985, the cooler will be ready for installation at the end of this year. In this report, we will describe the cooling device and its performance expected after the installation. 17 refs., 2 figs.

44945 (EGG/10282—1057, pp 20.1-20.13) **Accelerator beam diagnostics using a four-view image camera.** Chamberlin, D.D.; Hollabaugh, J.S.; Stump, C.J. Jr. (EG and G Energy Measurements Inc., Los Alamos, NM). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The cross-section geometry of intense particle beams may be measured by the visible light they emit. This section describes the imaging system used to collect and digitize the particle beam intensity profiles along four different axes. An input lens forms a cross-sectional image of the beam on a fiber optic image scope which has its output coupled through a microchannel plate intensified to a linear photodiode array. By using a four-leg image scope and an appropriate number of linear arrays, data from four views can be collected in one camera. The digitized intensity profiles are transmitted to solid state memory units accessible to a CAMAC-based microcomputer containing both spatial and phase-space tomographic reconstruction coding. The coding is used to reconstruct the cross-section geometry of the particle beam.

44946 **(FNAL-TM—1317) Design, installation, and commissioning of the D0 overpass at the Fermilab main ring.** Gerig, R.; May, M.; Moore, C.; Ohnuma, S.; Pruss, S.; Turkot, F. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—249). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016986.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

In order to accommodate large detectors for anti pp studies at the Tevatron, the Main Ring has been modified to be non-planar. A 700 foot-long portion of the ring has been reworked to create an overpass which displaces the beam orbit upwards by 51 inches at the D0 long straight section. The overpass region follows the "screw" geometry proposed by T. Collins. A set of four vertically bending dipoles were inserted into the Main Ring lattice; they are powered on a separate bus and operate at twice the current and field level of a standard bend. To make space for these vertical bends, at each vertical bend point two of the four standard dipoles in a half-cell are removed and the other two are powered at twice the current and field level of the rest of the ring. The vertical bends also have a set of trim coils powered by a separate supply so that any difference in the horizontal and vertical bending strengths can be compensated. The D0 overpass was commissioned with beam in November-December 1984. The principal effect on beam dynamics - predicted and observed - is the introduction of momentum dispersion in the vertical dimension of peak value 1.9m. To preserve closed orbit quality during acceleration, the vertical bends must track the rest of the ring with a precision of better than 0.1%. The Main Ring-Tevatron complex has now been running the fixed-target program for four months; the impact of the D0 overpass on accelerator performance has been minimal.

44947 **(FNAL-TM—1318) Improvement of the high voltage properties of the Fermilab electrostatic septa.** Trbojevic, D.; Crawford, C.; Childress, S.; Tinsley, D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—250). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016990.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

In the Fermilab Tevatron Switchyard proton beam splits ae initiated by a wire array electrostatic septum. At 1 TeV energy, and with fields limited to 50 kV/cm, an electrostatic septum more than 20 meters in length is required to produce the required angular separation between the beams for the Proton and Neutrino/Meson lines. New techniques have been investigated that will allow reliable operation at fields above 75 kV/cm with resultant beam line economy. Changes in construction and conditioning procedures have been studied using a short sample of an electrostatic septum. 14 refs., 5 figs.

44948 **(FNAL-TM—1321) Pulsed septum magnet for the Fermilab antiproton source.** Satti, J.A.; Holmes, S.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—259). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016993.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A 2 meter curved pulsed septum magnet for use in the Fermilab Antiproton Source is described. The magnet produces a peak

field of 6 kGauss at a current of 20,000 Amperes within a 0.4 msec long pulse. The field uniformity obtained is $\Delta B/B < 0.2\%$ out to 3.8 cm from the copper septum. Power enters the magnet from the center resulting in very simple ends and the magnet incorporates at 0.5 cm steel guard which reduces the field to <1.4 Gauss in the zero-field region. The total septum thickness is 1.3 cm. The vacuum enclosure doubles as the stacking fixture for the magnet laminations allowing easy assembly of a magnet with a 50 m radius of curvature.

44949 **(FNAL-TM—1331) TOM: a program for interactive lattice design.** Johnson, R.P.; Willeke, F. (Fermi National Accelerator Lab., Batavia, IL (USA); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—248). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016988.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An interactive program to help design accelerator lattices and lattice insertions is described. Present limitations and directions of future development are indicated.

44950 **(FNAL-TM—1333) Fermilab timeline generation system.** Johnson, R.P.; Knopf, W.R.; Thomas, A.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—254). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016992.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

In this paper the technique used to control the relative timing and synchronization of the major accelerator systems at Fermilab is described. The various operating modes of the injector accelerators include fixed target and colliding beam operation in conjunction with simultaneous machine studies. For example, in a 60 second interval the conventional main Ring may be called upon to: (a) load the Tevatron with 12 high intensity Booster batches each containing 82 rf bunches at 150 GeV, (b) transfer a Booster batch at 8 GeV with 8 rf bunches to the Debuncher or Accumulator, (c) accelerate high intensity beam several times to 120 GeV for antiproton production, and (d) accelerate beam to 150 GeV for Main Ring studies. In the case of colliding beam operation, the different tasks can be even more varied. All this requires a simple, flexible means of coordination.

44951 **(FNAL-TM—1336) Superconducting quadrupoles.** McInturff, A.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 34p. (CONF-8506152—3). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016995.

From CEBAF summer workshop; Newport News, VA, USA (3 Jun 1985).

The data base for this paper will represent the work from two different groups and two different Laboratories (Brookhaven National Laboratory and Fermi National Accelerator Laboratory). The majority of the data was that obtained by the Fermi National Accelerator Group and is the most recent, and is based on a larger number of coil windings. The coil winding sizes that will be discussed are 12 cm, (Figure 1) 7.6 cm and 5 cm, (Figure 2) for the inner diameter. The maximum gradients measured in the 5 cm sizes were 1.93 T/cm at 3.5 K and 1.79 T/cm at 4.2 K. In the 7.6 cm size were 1.35 T/cm at 2.0 K and 1.1 T/cm at 4.2 K and in the 12.0 cm size was 1.35 T/cm at 4.2 K. The 12 cm size used a cold iron shield, but had an older conductor, so one effect (increase due to Fe) offset the other (lower J/sub c/ (H) of the earlier superconductor). These gradients (especially the 12 cm measurements) can be improved using more modern conductors, (i.e., ~20% + g/(cm A) and their higher current densities. These gradients represent an increase of 2 to 3+ times the value obtainable using conventional iron and copper magnets at a comparable aperature. The original purposes for these coils were for the 12 cm size, the Isabelle lattice, the 7.6 cm size, the Tevatron lattice and low β insertion focus, and the 5 cm size, the final focus of SLC at SLAC and SSC size coils.

44952 **(FRNC-TH—1917) Electron optics properties of field emission tetrode guns and of a linear accelerator.** Roques, S. (Toulouse-3 Univ., 31 (France)). Oct 1982. 132p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752046.

Field emission gun, optical properties are recalled; the different methods to get the electrostatic potential are recalled too, more specifically the finite element method. The electron optics properties of the field emission tetrode guns are studied; specifically, the source image position has been studied as a function of the electric parameters; the spherical observation coefficients together with the source image radius as a function of electric and geometric parameters. A study of the same parameters in the case of a field emission tetrode gun followed by a linear accelerator is given.

44953 (INIS-SU—284, pp vp) **Method for measuring longitudinal emittance of a charged particle beam.** Tron', A.M. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)); Feshchenko, A.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781488. (CONF-8306180—No.3(15)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

A technique is considered for determination of longitudinal phase distribution of an accelerated beam in the form of an effective ellipse according to three dimensions of the beam phase extension at the outlet of devices with known matrices of longitudinal motion. The error of measuring effective phase ellipse is shown to be determined mainly by resolution of the phase extension meter and by error of measuring field amplitudes in the resonator. It depends on orientation of the ellipse being measured on the longitudinal phase plane. Results are presented of numerical simulation of measuring in the meson factory of the Nuclear Research Institute, the AS USSR.

44954 **(LA-UR—85-1627) Scheme to funnel ion beams with a radio-frequency quadrupole.** Stokes, R.H.; Minerbo, G.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 17p. (CONF-8505164—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015689.

From Workshop on high brightness, high current, high duty factor ion injectors; San Diego, CA, USA (21 May 1985).

We describe a proposed method to funnel ion beams using a new form of the radio-frequency quadrupole (RFQ) structure. This RFQ accepts two bunched ion beams and combines them into a single final beam with interlaced microstructure pulses. It also provides uninterrupted periodic transverse focusing to facilitate the funneling of beams with high current and low emittance.

44955 **(LA-UR—85-2556) Summary from working group on multiple beams and funneling.** Wangler, T.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-8505164—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015694.

From Workshop on high brightness, high current, high duty factor ion injectors; San Diego, CA, USA (21 May 1985).

The working group on Multiple Beams and Funneling discussed various topics related to multiple beams and funneling, including (1) design considerations for multiple-beam accelerators; (2) scaling of current, emittance, and brightness for multiple-beam systems; (3) funneling lines using either discrete components or a radiofrequency quadrupole (RFQ) funneling structure; and (4) alternatives to funneling.

44956 **(LBL—18797) Suppression of propagating TE modes in the FNAL antiproton source stochastic beam cooling system.** Barry, W.C. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 5p. (CONF-850504—280). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016559.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A method of attenuating the propagation of waveguide modes in the stochastic cooling array beam pipes to be utilized in

the accumulator and debuncher rings of the Fermilab antiproton source is described. The attenuation method treated involves lining the vertical walls of the beam pipes with a ferrimagnetic material. The general solution for propagation in a nonhomogeneously loaded waveguide is presented along with numerical results specific to the antiproton source beam cooling system. Also described is a broadband, automated technique for the simultaneous measurement of complex μ and ϵ developed to aid in the characterization of different ferrite materials. Permittivity and permeability data for a typical ferrite are presented along with a discussion of the effects of these parameters on waveguide mode attenuation in the ferrite lined beam pipes.

44957 **(LBL—19483) Numerical solution of boundary condition to POISSON's equation and its incorporation into the program POISSON.** Caspi, S.; Helm, M.; Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—246). NTIS, PC A02/MF A01. File Number DE85016637.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Two dimensional cartesian and axially-symmetric problems in electrostatics or magnetostatics frequently are solved numerically by means of relaxation techniques - employing, for example, the program POISSON. In many such problems the "sources" (charges or currents, and regions of permeable material) lie exclusively within a finite closed boundary curve and the relaxation process in principle then could be confined to the region interior to such a boundary - provided a suitable boundary condition is imposed onto the solution at the boundary. This paper discusses and illustrates the use of a boundary condition of such a nature in order thereby to avoid the inaccuracies and more extensive meshes present when alternatively a simple Dirichlet or Neumann boundary condition is specified on a somewhat more remote outer boundary.

44958 **(LBL—19527) Effect of focusing field nonlinearities in MBE-4 on transverse beam dynamics.** Celata, C.M.; Brady, V.O.; Laslett, L.J.; Smith, L.; Haber, I. (Lawrence Berkeley Lab., CA (USA); Naval Research Lab., Washington, DC (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—255). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016561.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A particle simulation code was used to study the effect on transverse beam dynamics of nonlinearities of the focusing field in a linear accelerator transporting a multiple beam array. Nonlinear field strengths for various multiple-beam design geometries were calculated by relaxation codes for use in the simulation calculation. Nonlinearities due to asymmetry of the electrode array with respect to a single beam were found to be negligible. Electrode end effect nonlinearities led to emittance growth for off-axis beams, though for the geometry of MBE-4, this was negligible. For misaligned beams, a dodecapole field caused significant emittance growth. This was not seen in single particle tracking calculations. Fields due to induced charge on the electrodes can reduce this effect, or the dodecapole field can be eliminated by proper choice of the electrode radius.

44959 **(LBL—19560) Transportable charge in a periodic alternating gradient system.** Lee, E.P.; Fessenden, T.J.; Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—239). NTIS, PC A02. File Number DE85016554.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A simple set of formulas is derived which relate emittance, line charge density, matched maximum and average envelope radii, occupancy factors, and the (space charge) depressed and vacuum values of tune. This formulation is an improvement on the smooth limit approximation; deviations from exact (numerically determined) relations are on the order of +-2%, while the smooth limit values are in error by up to +-30%. This transport formalism is used to determine the limits of transportable line charge density in an electrostatic quadrupole array, with specific application to the low energy portion of the High Temperature Experiment of Heavy Ion Fusion Accelerator Research. The line charge density limit is found to be essentially proportional to the voltage on the pole faces and the fraction of occupied aperture area. A finite injection energy ($\geqq$ 2 MeV) is required to realize this limit, independent of particle mass.

44960 **(LBL—19798) Model equations for high current transport.** Lee, E.P. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 11p. (CONF-8503105—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016566.

From Orbital dynamics and applications to accelerators workshop; Berkeley, CA, USA (7 Mar 1985).

The use of distribution functions to model transverse beam dynamics is discussed. Emphasis is placed on envelope equations, moments, the Vlasov equation, and the Kapchinski-Vladimirskij distribution. 10 refs.

44961 **(UCRL—92172) Electromagnetic effects in relativistic electron beam plasma interactions.** Kruer, W.L.; Langdon, A.B. (Lawrence Livermore National Lab., CA (USA)). 13 Feb 1985. Contract W-7405-ENG-48. 8p. (CONF-850128—18). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016071.

From 2. international workshop on laser acceleration of particles; Los Angeles, CA, USA (7 Jan 1985).

Electromagnetic effects excited by intense relativistic electron beams in plasmas are investigated using a two-dimensional particle code. The simulations with dense beams show large magnetic fields excited by the Weibel instability as well as sizeable electromagnetic radiation over a significant range of frequencies. The possible relevance of beam plasma instabilities to the laser acceleration of particles is briefly discussed. 6 refs., 4 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 44929, 45023, 45912

44962 **(AECL—8556) TASCC - the next five years.** Hardy, J.C.; Horn, D.; Ward, D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701984.

The Tandem Superconducting Cyclotron (TASCC) Project at Chalk River is nearing completion of Phase I construction. The accelerator facilities are described as are the major pieces of experimental equipment that will be available: the Q3D magnetic spectrometer, the on-line isotope separator, the 8π γ-ray spectrometer, and the multiparticle detector systems. Research at TASCC will focus on the study of nuclei at extremes -extremes of density, temperature, high spin, high excitation and exotic nucleonic composition. The principal experimental programs are outlined under three headings: heavy ion reaction phenomena at transitional energies, nuclear states at high excitation and angular momentum, and exotic nuclei.

44963 **(BONN-HE—85-05) Polarized targets and beams.** Meyer, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jan 1985. 28p. (CONF-8410227—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752084.

From Workshop on electron and photon interactions at medium energies; Bad Honnef, F.R. Germany (29 Oct 1984).

First the experimental situation of the single-pion photoproduction and the photodisintegration of the deuteron is briefly discussed. Then a description of the Bonn polarization facilities is given. The point of main effort is put on the polarized target which plays a vital role in the program. A facility for photon induced double polarization experiments at ELSA will be presented in section 4. Properties of a tensor polarized deuteron target are discussed in section 5. The development in the field of polarized targets, especially on new target materials, enables a new generation of polarized target experiments with (polarized) electrons. Some comments on the use of a polarized target in combination with electron beams will be discussed in section 6. Electron deuteron scattering from a tensor polarized deuteron target is considered and compared with other experimental possibilities.

44964 **(BONN-IR—85-02) Bonn 500 MeV electron synchrotron: 1958-1984.** Mecking, B. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1985. 47p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751887.

In this report the main parameters of the 500 MeV Synchrotron as well as the scientific papers made at the accelerator are compiled.

44965 (CERN—84-15, pp 291-318) **SPS p anti p collider.** Gareyte, J. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The purpose of this lecture is to give a general idea of how the collider works. The fact that one of the beams is composed of scarce precious antiprotons imposes strong constraints on the operation of such a machine. Solutions to these specific problems will be described.

44966 (CERN—84-15, pp 369-383) **Stability of ions in bunched-beam machines.** Brianti, G. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

In this paper, the conditions leading to the accumulation of ions are established for various cases of bunched beams, together with the maximum ion density which can be reached. An application to the SPS p anti p collider is also given.

44967 (CERN—84-15, pp 79-96) **Anti p production and collection.** Jones, E. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

Antiprotons emerge from the target, along with many other fundamental particles, and are focused by a cylindrical lens, called a magnetic horn, into the beam transport system. The latter consists of an arrangement of strong focusing quadrupoles and a spectrometer magnet.

44968 (CERN—84-15, pp 163-182) **Stochastic cooling hardware.** Taylor, C.S. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The author describes the equipment and methods for stochastic cooling.

44969 (CERN—84-15, pp 183-196) **Optimum gain and phase for stochastic cooling systems.** Meer, S. van der. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

A detailed analysis of optimum gain and phase adjustment in stochastic cooling systems reveals that the result is strongly influenced by the beam feedback effect and that for optimum performance the system phase should change appreciably across each Schottky band. It is shown that the performance is not greatly diminished if a constant phase is adopted instead. On the other hand, the effect of mixing between pick-up and kicker (which produces a phase change similar to the optimum one) is shown to be less perturbing than is usually assumed, provided that the absolute value of the gain is not too far from the optimum value.

44970 (CERN—84-15, pp 197-214) **Feasibility study of stochastic cooling of bunches in the SPS.** Boussard, D.; Chattopadhyay, S.; Dome, G.; Linnecar, T. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The average luminosity of the SPS collider could be improved if the slow blow-up of transverse emittances due to beam-beam and intrabeam scattering effects were to be reduced by a transverse cooling system. We examine the parameters of such a system and propose a technological approach which seems better suited to the case of a few bunches circulating in a large machine.

44971 **(CERN—84-16) System software of the CERN proton synchrotron control system.** Carpenter, B.E.; Cailliau, R.; Cuisinier, G.; Remmer, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 20 Dec 1984. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701986.

The PS complex consists of 10 different interconnected accelerators or storage rings, mainly controlled by the same distributed system of NORD-10 and ND-100 minicomputers. After a brief outline of the hardware, this report gives a detailed description of the system software, which is based on the SINTRAN III operating system. It describes the general layout of the software, the network, CAMAC access, programming languages, program development, and microprocessor support. It concludes with reviews of performance, documentation, organization and methods, and future prospects.

44972 **(FNAL-TM—1316) Simulation of quenches in SSC magnets with passive quench protection.** Koepke, K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016989.

The relative ease of protecting an SSC magnet following a quench and the implications of quench protection on magnet reliability and operation are necessary inputs in a rational magnet selection process. As it appears likely that the magnet selection will be made prior to full scale prototype testing, an alternative means is required to ascertain the surviveability of contending magnet types. This paper attempts to provide a basis for magnet selection by calculating the peak expected quench temperatures in the 3 T Design C magnet and the 6 T Design D magnet as a function of magnet length. A passive, "cold diode" protection system has been assumed. The relative merits of passive versus active protection systems have been discussed in a previous report. It is therefore assumed that - given the experience gained from the Tevatron system - that an active quench protection system can be employed to protect the magnets in the eventuality of unreliable cold diode function.

44973 **(FNAL-TM—1319) Pulsed power supplies for the Fermilab 1 TeV switchyard.** Bartelson, L.; Walton, J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 3p. (CONF-850504—251). NTIS, PC A02. File Number DE85016983.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An upgraded system of pulseed switching magnets has been implemented in the Fermilab Switchyard to accommodate proton energies up to 1 TeV. These devices are required for switching the "slow" and "fast" extracted beams into their respective beam lines. "Slow" beam passes undeflected through the magnet in the off condition. During a puls "slow" is disabled and "fast", which is of $\sim$1 ms duration, is deflected. The requirement then is for a "flat-top" current pulse of minimum rise and fall time. The circuit chosen is of the resonant charge recovery type. Several different styles and combinations of magnets and constraints. In all cases maximum voltage is limited to 600 volts and pulse width to 100 ms.

44974 **(FNAL-TM—1320) Abort kicker power supply systems at Fermilab.** Krafczyk, G.; Dugan, G.; Harrison, M.; Koepke, K.; Tilles, E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—253). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016991.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Over the past several years, Fermilab has been operating with a single turn proton abort system in both the superconducting

Tevatron and the conventional Main Ring. The abort kicker power supply for this system discharges a lumped capacitance into the inductive magnet load, causing the beam to enter the abort channel. The characteristics of this current waveform are defined by the requirements of the machine operation. The standard fixed target running mode calls for 12 booster batches of beam which leaves a rotating gap in the beams of ~1.8 μs. The current waveform is required to rise to 90% of I/sub max/ in this time to avoid beam loss from partially deflected beam. Aperture limitations in both the accelerator and the abort channel demand that the current in the magnets stays above this 90% I/sub max/ for the 21 μs needed to ensure all the beam has left the machine. The 25 mm displacement needed to cleanly enter the abort channel at 1 TeV corresponds to a maximum current in each of the 4 modules of ~20 kA. Similar constraints are needed for the Main Ring and Tevatron antiproton abort systems. A unique feature of this design is the high voltage, high current diode assembly used to clip the recharge of the capacitor bank. This allows the current to decay slowly with the L/R time constant of the magnet and diode series combination. Special attention is given to the diode characteristics needed for this passive switching element. Operational experience and proposed upgrades are given for the two operational systems. 2 refs., 4 figs., 1 tab.

44975 (FNAL-TM—1322) Tevatron extraction microcomputer. Chapman, L.; Finley, D.A.; Harrison, M.; Merz, W. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—252). NTIS, PC A02. File Number DE85016985.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Extraction in the Fermilab Tevatron is controlled by a multiprocessor Multibus microcomputer system called QXR (Quad eXtraction Regulator). QXR monitors several analog beam signals and controls three sets of power supplies: the "bucker" and "pulse" magnets at a rate of 5760 Hz, and the "QXR" magnets at 720 Hz. QXR supports multiple slow spills (up to a total of 35 seconds) with multiple fast pulses intermixed. It linearizes the slow spill and bucks out the high frequency components. Fast extraction is done by outputting a variable pulse waveform. Closed loop learning techniques are used to improve performance from cycle to cycle for both slow and fast extraction. The system is connected to the Tevatron clock system so that it can track the machine cycle. QXR is also connected to the rest of the Fermilab control system, ACNET. Through ACNET, human operators and central computers can monitor and control extraction through communications with QXR. The controls hardware and software both employ some standard and some specialized components. This paper gives an overview of QXR as a control system; another paper summarizes performance.

44976 (FNAL-TM—1332) Control and initial operation of the Fermilab BO low β insertion. Finley, D.A.; Johnson, R.P.; Willeke, F. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—258). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016994.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The operation of the Fermilab BO low β insertion involves the coordinated control of the 4 strings of quadrupoles of the insertion itself along with several magnetic correction elements (20 dipoles for the closed orbit, 2 quad circuits for betatron tunes, 1 skew quad circuit for coupling, and 2 sextupole circuits for chromaticity). When the beam is stored at high energy, these elements must correct the errors induced by the strong superconducting quadrupoles of the insertion as the optics are smoothly changed from the fixed target configuration to the low β state. The techniques and control programs for these manipulations and initial tests using a single coasting beam are described. 6 refs., 4 figs.

44977 (IPNO-GEPL—83-03) Optical properties of the electrostatic mirror: application to the Orsay project. Schapira, J.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 31p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751210.

Optical properties-transfer matrix and acceptance-of the electrostatic mirror have been calculated for any transit time value. Advantage of this type of inflector for axial injection into a compact cyclotron are discussed. Nevertheless one points out that the use of a mirror implies beam of very good quality, due to large transit time fluctuation related to the geometrical emittance. This is specially relevant to the case of the Orsay project, where one aims at a phase grouping of few R.F. degrees.

44978 (LBL—19487) Alumino-silicate ion sources for accelerator applications. Warwick, A.I. (Lawrence Berkeley Lab., CA (USA)). Apr 1985. Contract AC03-76SF00098. 6p. (CONF-850504—237). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016628.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

As part of the program of Heavy Ion Fusion Accelerator Research at the Lawrence Berkeley Laboratory, ion sources have been developed using thermionic emitters of singly charged alkali metal ions. These emitters are flat surfaces of alumino-silicate, loaded with the appropriate ion. They have become convenient and reliable sources producing pulsed beams of very low emittance. Thermionic emission of ions from alumino-silicates has been known for a very long time. Here the author focuses on the practical application as accelerator ion sources. The author discusses the fabrication and heating of large area emitters, uniformity of emission and the maximum ion current density which can be extracted under space charge limited conditions, with zero electric field on the emitter surface. Results are presented for Na, K and Cs ions showing maximum space charge limited current densities of 25, 40 and 120 $mAcm^{-2}$ respectively. In the case of cesium the author has produced a 5 mA beam at a kinetic energy of 200 keV with normalized emittance 1.2×10^{-7} π m rad.

44979 (LBL—19561) Effect of manufacturing errors on field quality of dipole magnets for the SSC. Meuser, R.B. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—244). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016634.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

For superconducting dipole magnets of the sort proposed for the Superconducting Super Collider, the effects of various random manufacturing errors upon random magnet-to-magnet magnetic-field aberrations are analyzed. The errors considered are ones that are directly related to manufacturing tolerances and measurable dimensions of parts and materials. These errors affect the position of the boundaries of each layer of conductors in each quadrant and the positions of conductors within those boundaries. Manufacturing errors were estimated for the Fermilab Tevatron magnets and the BNL CBA magnets. The estimates were then adjusted so that the calculated field aberrations matched the measured values. Those errors were then applied to the SSC magnet reference designs currently under study in order to obtain estimated field aberrations.

44980 (LBL—19584) CSEM-steel hybrid wiggler/undulator magnetic field studies. Halbach, K.; Hoyer, E.; Marks, S.; Plate, D.; Shuman, D. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—245). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016635.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Current design of permanent magnet wiggler/undulators use either pure charge sheet equivalent material (CSEM) or the CSEM-Steel hybrid configuration. Hybrid configurations offer higher field strength at small gaps, field distributions dominated by the pole surfaces and pole tuning. Nominal performance of the hybrid is generally predicted using a 2-D magnetic design code neglecting transverse geometry. Magnetic measurements are presented showing transverse configuration influence on performance, from a combination of models using CSEMs, REC (H/sub c/ = 9.2 kOe) and NdFe (H/sub c/ = 10.7 kOe), different pole widths and end configurations. Results show peak field improvement using NdFe in place of REC in identical models, gap peak field decrease with pole width decrease (all results less than computed 2-D fields), trans-

verse gap field distributions, and importance of CSEM material overhanging the poles in the transverse direction for highest gap fields.

44981 (NAC-AR—83-01, pp 111-119) **Control system.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

The control system of the NAC accelerators was designed around a number of 16-bit mini-computers, 8-bit micro-computers and CAMAC Fisher System crate interfacing equipment. The following aspects are discussed: the activities concerning control system mini-computers, the CAMAC direct-memory-access facility, hardware developments, mini-computer application software and also microprocessor activities.

44982 (NAC-AR—83-01, pp 180-187) **Buildings.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

In this part of the report the buildings of the NAC cyclotron are discussed. During the past year the cyclotron hall was completed, as well as the cyclotron block. The building of the hospital and patient-handling areas are also discussed.

44983 (NAC-AR—83-01, pp 7-56) **Light-ion injector.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

In an extensive field mapping program the magnetic fields of the main coils and various pole-gap coils of the light-ion injector (SPC1) were measured. As a further test, the measured field maps were used to calculate the excitation currents through the various coils for a specific field shape. Orbit calculations, based on the electric potential fields measured is the electrolytic tank on the 3:1 scale model of the central region, made it possible to optimise the ion-source position, improve the axial focussing of the beam and specify an approximate position for the second axial. The coils for the first magnetic channel were manufactured and field measurements with the channel in position in the pole-gap have been performed. The radio-frequency system of SPC1 consists of three main sections, namely resonators, power amplifiers and the control systems. The purpose of the RF-system is to provide the accelerating voltages of up to 70 kV peak in the 8,6 to 26 MHz frequency range, which are required to accelerate the particle beams.

44984 (NAC-AR—83-01, pp 57-110) **Separated-sector cyclotron.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

Three of the four sector magnets have been completed. All trimcoils have also been manufactured. The magnetic field mapping equipment is also operational. The radio-frequency system for the SSC(Seperated-sector cyclotron) consists of three main sections, namely the resonators, power amplifiers, and the control systems. The manufacturing of the two resonators are discussed. The vacuum system and pumping system of the cyclotron are also discussed, as well as the magnetic inflection channel and bending magnets for beam injetion. This part of the report also deals with the beam extraction, beam diagnostics and orbit calculations.

44985 (NAC-AR—83-01, pp 229-234) **Medical component.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

The neutron therapy and proton therapy facilities at the National Accelerator Centre are discussed. Experiments were done on the positioning of patients during computerized tomography.

44986 (NAC-AR—83-01, pp 188-212) **Pretoria Cyclotron Group.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

In this part of the report the following aspects are discussed: Cyclotron operation and development; production of radioisotopes; neutron therapy facilities; physical neutron studies; biological neutron studies and services to industry and other organisations. As for the operation of the cyclotron, the RF frequency stabilizer has been replaced by a new system and a design study completed for modifying the ion-source gas supply system. Attention was given to various radioisotope production procedures, including improved methods for the recovering of ^{139}Ce from bombarded La targets and ^{77}Br from bombarded As_2O_3 targets. A treatment room was constructed for neutron therapy and the variable neutron collimator was installed.

44987 (NAC-AR—83-01, pp 213-215) **Van de Graaff Group.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

The following aspects of the Van de Graaff Group's activities are discussed: nuclear structure studies, the programme of atomic physics, the techniques used for elemental and isotopic analysis, solid state interactions, and the applications of nuclear techniques in industry and the environment.

44988 (NAC-AR—83-01, pp 120-154) **Beam transport system.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983. [Control system of the NAC accelerator].

During the year all the quadropole and dipole magnets for the transfer beamline have been delivered, and the assembly of this beamline is now receiving attention. The harmonic analysis of a quadropole has been simulated using a magnetic model, and the necessary electrochemical apparatus has been manufactured and shipped. A conversion of the programme TRANSPORT into an interactive graphics version for use at the control console is in progress. The majority of the beam diagnostics equipment for the low-energy transfer beamline has been received and tested. Most of the vacuum equipment required for the transfer beamline has been received.

44989 **(NAC-AR—83-01) Annual report June 1983. [Control system of the NAC accelerator].** (Council for Scientific and Industrial Research, Faure (South Africa). National Accelerator Centre). 1983. 271p. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

Abstracts of individual items from the report were prepared separately for the data base. (GHT)

44990 **(SLAC-PUB—3624-Rev.) Control problems in very large accelerators.** Crowley-Milling, M.C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC03-76SF00515. 14p. (CONF-850504—103-Rev.). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014956.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

There is no fundamental difference of kind in the control requirements between a small and a large accelerator since they are built of the same types of components, which individually have similar control inputs and outputs. The main difference is one of scale; the large machine has many more components of each type, and the distances involved are much greater. Both of these factors must be taken into account in determining the optimum way of carrying out the control functions. Small machines should use standard equipment and software for control as much as possible, as special developments for small quantities cannot normally be justified if all costs are taken into account. On the other hand, the very great number of devices needed for a large machine means that, if special developments can result in simplification, they may make possible an appreciable reduction in the control equipment costs. It is the purpose of this report to look at the special control problems of large accelerators, which the author shall arbitarily define as those with a length of circumference in excess of 10 km, and point out

where special developments, or the adoption of developments from outside the accelerator control field, can be of assistance in minimizing the cost of the control system. Most of the first part of this report was presented as a paper to the 1985 Particle Accelerator Conference. It has now been extended to include a discussion on the special case of the controls for the SSC.

44991 **(SLAC-PUB—3712) Rx for hung users.** Johnston, T.Y. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC03-76SF00515. 9p. (CONF-850294—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015263.

From SHARE 64 conference; Los Angeles, CA, USA (24 Feb 1985).

An examination of a methodology for freeing hung virtual machines.

44992 **Direct observation of energetic-particle-beam-induced effects in the Argonne National Laboratory high voltage electron microscope.** Taylor, A.; Ryan, E.A.; Philippides, A.; Wallace, J.R. (Argonne National Lab., IL (USA)). *Materials Science and Engineering;* **69**: No. 2, 457-463(Mar 1985). (CONF-8409130—).

From International conference on surface modification of metals by ion beams; Heidelberg, F.R. Germany (17 Sep 1984).

Direct observations in the high voltage electron microscope of electron- and ion-beam-induced effects in solids now form a significant part of the research activity at the Argonne National Laboratory High Voltage Electron Microscope Tandem Facility. The programs utilize unique facilities that permit samples held at temperatures between 10 and 1300 K to be bombarded in vacuo with ions having energies between 20 keV and 8 MeV. Instrumentation both internal and external to the high voltage electron microscope has been provided to characterize fully the ion beam at the specimen rod over a wide range of beam intensities. Several studies of radiation damage in pure metals and model alloys that have contributed to an advancement in the understanding of defect production and cascade behavior are reviewed. A recent study of amorphization in a Cu-Bi bilayer film is also given.

44993 **New ion sources for nuclear structure studies at the TRISTAN facility.** Gill, R.L.; Piotrowski, A. (Brookhaven National Lab., Upton, NY (USA)). pp 595-602 of Proceedings of the International symposium on in-beam nuclear spectroscopy held at Debrecen, Hungary, 14-18 May 1984. Vol. 2. Dombradi, Zs.; Fenyes, T. (eds.). Budapest, Hungary; Akademiai Kiado (1984). (CONF-840530—Vol.2).

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

TRISTAN is an on-line isotope separator (ISOL) facility located at Brookhaven National Laboratory's High Flux Beam Reactor. Short-lived neutron-rich nuclei, far from stability, are produced by thermal neutron fission of U-235. These nuclei can be studied using facilities at the five available beam lines. These facilities include: a 4-detector angular correction system, a delayed neutron spectroscopy facility, a conversion electron detector, a colinear fast beam dye laser system and a superconducting magnet for g-factor measurements. Ion sources of the surface ionization, negative surface ionization, thermal, FEBIAD, and plasma types are used to provide high yields over a wide range of elements for experiments at the available detector stations.

4304 Storage Rings

REFER ALSO TO CITATION(S) 44928

44994 **(BNL—51909) Collider performance with ideal collisions.** Month, M. (Brookhaven National Lab., Upton, NY (USA)). 1 Jun 1985. Contract AC02-76CH00016. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017011.

Performance is estimated for head-on bunch collisions. The luminosity is written as a distribution in time and length along the collision path, using a Gaussian distribution in all space dimensions. Computations are made for the Tevatron. Sources of luminosity reduction are listed in the case of non-ideal conditions.

44995 **(CEA-CONF—7591) Micro-temporal and spectral structure of storage ring free electron lasers.** Elleaume, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 2p. (In French and English). (CONF-8409144—5-Abst.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752031.

From Free electron laser conference; Castelgandolfo, Italy (3 Sep 1984).

Published in summary form only.

44996 (CERN—84-15, pp 469-485) **Gas jet targets.** Macri, M. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The use of a molecular gas 'jet' as an internal target in a storage ring is described.

44997 (CERN—84-15, pp 33-61) **Lattices for antiproton rings.** Autin, B. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

After a description of the constraints imposed by the cooling of Antiprotons on the lattice of the rings, the reasons which motivate the shape and the structure of these machines are surveyed. Linear and non-linear beam optics properties are treated with a special amplification to the Antiproton Accumulator.

44998 (CERN—84-15, pp 261-290) **RF techniques for p anti p.** Boussard, D. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

We examine a few typical examples related to proton or antiproton storage rings.

44999 (CERN—84-15, pp 487-507) **LEAR.** Lefevre, P. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

In general LEAR provides a precise experimental tool which: opens the domain of low energy quark dynamics (chemistry of quarks by carrying experiments connected to baryonium, gluonium, etc..), using nuclear targets it allows to tackle the nuclear physics aspects in a completely new fashion, permits many exciting applications to future options due to the further improvements on statistical precision and energy resolution ($\Delta p/p$): internal targets, H^- anti p co-rotating beams (protonium formation in flight), p anti p collider and ultra low energy domain (down to 20 MeV/c.).

45000 (CERN—84-15, pp 509-524) **Antiprotons in the CERN intersecting storage rings.** Bryant, P.J. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

High-sensitivity electronics for TT1 and ring 2 had been developed and installed, the original experimental stochastic cooling systems in the ISR were rebuilt and considerably improved, the split-field magnet (SFM) vacuum chamber was modified, some steering dipoles were designed, made and installed, and finally innumerable interlocks and computer programs were revised for antiproton operation.

45001 (CERN—84-15, pp 525-547) **CERN antiproton collector.** Autin, B. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The Antiproton Collector is a new ring of much larger acceptance than the present accumulator. It is designed to receive 10^8 antiprotons per PS cycle. In order to be compatible with the Antiproton Accumulator, the momentum spread and the emittances are reduced from 6% to 0.2% and from 200 π mm mrad to 25 π mm mrad respectively. In addition to the ring itself, the new target area and the modifications to the stochastic systems of the Antiproton Accumulator are described.

45002 **(LBL—19486) Lattice and bypass design for a coherent xuv facility.** Jackson, A.; Garren, A.A.; Vignola, G. (Lawrence Berkeley Lab., CA (USA); Brookhaven National Lab., Upton, NY (USA)). May 1985. Contract AC02-76CH00016;AC03-76SF00098. 6p. (CONF-850504—242). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016556.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The design of a magnet lattice and bypass for a coherent radiation facility is discussed. The lattice is the missing magnet FODO structure first proposed by Vignola for a 6 GeV light source. This has been adapted for a 750-1300 MeV electron storage ring for use with both conventional insertion devices and a high gain FEL optimized for output at 400 A. The latter device requires that the electron bunch be deflected into a small aperture bypass, then reinjected into the ring where the perturbing effects of the FEL are damped out. 8 refs., 7 figs.

45003 **(LBL—19488) Collective effects and lattice implications for an FEL bypass ring.** Bisognano, J.; Jackson, A.; Zisman, M.S. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—243). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016563.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Optimizing the performance of a single-pass free electron laser (FEL) in a storage ring requires a stored beam having both a relatively high volume density and a low momentum spread. These requirements place severe constraints on storage ring design due to the impact of both coherent and incoherent multiparticle phenomena. In this paper we present approximate scaling laws that elucidate the relative importance of various lattice parameters, and we will describe a systematic approach (embodied in the computer code ZAP) to parameter selection. 9 refs., 1 fig.

45004 **(SLAC-PUB—3713) Linear colliders - prospects 1985.** Rees, J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC03-76SF00515. 9p. (CONF-850721—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015259.

From International Europhysics conference on high energy physics; Bari, Italy (18 Jul 1985).

We discuss the scaling laws of linear colliders and their consequences for accelerator design. We then report on the SLAC Linear Collider project and comment on experience gained on that project and its application to future colliders. 9 refs., 2 figs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 43835, 44734, 44747, 44752, 44753, 44754, 44900, 44912, 45569, 45574, 45574, 45579, 45722

45005 **(AD-A—154676/1/XAB) Results from radiation-monitoring equipment experiments on STS-41C, 41D, 41G, and 51A. Final report, 3 February-16 November 1984.** Cash, S.E.; Madonna, R.G.; McClellan, M.R.; Fields, M.E. (Air Force Technical Applications Center, Patrick AFB, FL (USA)). 18 Apr 1985. 98p. NTIS, PC A05/MF A01.

The results from the radiation monitoring equipment (RME) experiments, flown onboard STS-41C, 41D, 41G, and 51A are presented and discussed. The RME consists of the HRM-III gamma-ray counter and PRM neutron/proton dosimeter. The gamma-ray data agree with data from previous flights with somewhat higher readings on STS-41G. Large increases in count rates are observed when the Orbiter is in the South Atlantic and Southeast Asian Anomalies. Increases in count rate are also observed at higher latitudes. Neutron/proton dosage is consistent with NASA predictions.

45006 **(AECL—8058) Collisions of neutrons and of gamma rays in $Bi_4Ge_3O_{12}$ (BGO) and NaI(Tl) scintillation detectors.** Kushneriuk, S.A.; Lone, M.A.; Hausser, O.; Wong, P.Y. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702024.

The role of collision/escape probabilities in establishing the prompt response of bismuth germanate and NaI(Tl) scintillators is investigated. A possible approximation to the collision probability is discussed. Exact expressions for the probability of escape of radiation from finite, right circular cylindrical and rectangular parallelepiped-shaped detectors are derived from an exponential-like spatial distribution of the source in the detector medium and a parametrized angular distribution of emission of the source. Fairly extensive tables of collision probabilities calculated for these bodies are given. For purposes of comparison some results obtained previously in a Monte Carlo calculation are also presented and discussed.

45007 **(AECL—8109) Self-powered flux detectors. A bibliography with summaries.** Shields, R.B. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1983. 295p. NTIS (US Sales Only), PC A13/MF A01. File Number DE85702025.

This bibliography attempts to cover the published literature on the class of radiation detectors most often referred to as 'self-powered'. For this purpose, self-powered detectors are defined as those that have two or more conducting electrodes separated by solid insulation and that generate a signal current without an external power source. Primary sensitivity is unrestricted, but it is usually to neutrons or gamma-rays. The main application is in the core of a nuclear reactor. All relevant facets of the subject are covered including: theory, experiment, development, design, manufacture, instrumentation and application. In addition to the usual reference information, various other designations are included where available, such as CONF-and abstract serial numbers. Where possible, a summary of the content is given with emphasis on specific results and conclusions. Indexing is by author and subject.

45008 (ANL—84-103-Pt.2, pp 91-185) **Problems and precision of the alpha scintillation radon counting system.** Lucas, H.F.; Markuu, F. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Variations in efficiency as large as 3% have been found for radon scintillation counting systems in which the photomultiplier tubes are sensitive to the thermoluminescent photons emitted by the scintillator after exposure to light or for which the resolution has deteriorated. The additional standard deviation caused by counting a radon chamber on multiple counting systems has been evaluated and the effect, if present, did not exceed about 0.1%. The chambers have been calibrated for the measurement of radon in air, and the standard deviation was equal to statistical counting error combined with a systematic error of 1.1%. 3 references, 2 figures, 2 tables.

45009 **(BNL—36748) Thoughts on an e^+e^- detector for RHIC.** Tannenbaum, M.J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-8504152—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016053.

From Workshop on experiments for RHIC; Upton, NY, USA (15 Apr 1985).

Electron-positron pairs may be a penetrating probe of the quark-gluon plasma. The main background to e^+e^- pair production are random hadron pairs misidentified as electrons, and random electron pairs from internal and external conversions of photons from neutral pion and neutral eta decays. It is unlikey that a quark-gluon plasma will be produced on every interaction at the Relativistic Heavy Ion Collider, so a trigger will be required to select

events in which the plasma is likely to be produced. A subtle indicator of plasma formation is to look for plasma droplets cause by deflagration. The electron-positron pairs would be detected in two highly instrumented magnetic spectrometers. A strategy for lepton pair detection is outlined, followed by an example of a detector for the RHIC. 14 refs., 2 figs., (LEW)

45010 **(CAPE—2955) University of Illinois elementary particle physics research, MKIII Muon Detector components (Engineering Materials).** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 30 Mar 1982. Contract AC03-76SF00515. H. File Number TI85016538.

These drawings provide engineering details on components of the MKIII Muon Detector used in elementary particle physics resarch at the University of Illinois.

45011 **(CEA-R—5273) Influence of different irradiation facilities on the response of radioprotection devices.** Heeren de Oliveira, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France); Institut National Polytechnique, 38 - Grenoble (France)). May 1984. 222p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751218.

An EIC 1 extrapolation chamber, flushed with a methane based tissue equivalent gas is presented. This measuring device serves as a reference instrument to calibrate in tissue absorbed dose beta beams from different irradiation facilities; point radioactive sources, sources used with beam flattening filters, large area sources simulated by moving a point source. The source to detector distance has to be greater than 3 cm, requiring a transfer dosemeter for smaller distances. Influence of these different irradiation geometries has been studied on several radioprotection instruments (babyline, individual dosemeter, ionisation chamber), using three radionucleides: ^{147}Pm, ^{204}Tl, $^{90}Sr + {}^{90}Y$.

45012 **(CEA-R—5280) Absolute and intrinsic response probabilities of scintillators presenting straight truncated cylindrical geometries to photons imitted by sources of the same shape.** Becker, A.; Gorry, J.; Lame, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1984. 56p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751202.

Many "sources" of radioactive substances possess cylindrical geometry (waste drums for example) and gamma spectrometric detectors, as far as their active (selective) elements are concerned, are generally characterised by rotational symmetry about an axis. Such a situation may offer an analytical approach to the determination of the response of a cylindrical detector to a radiation produced homogeneously in a cylindrical emitter. Owing to the selective possibilities of spectrometry (in particular photoelectric effect) it is possible to reason purely in terms of transmission and absorption, which allows a formulation of the kind encountered in geometrical optics. In the present text we have developed the analytical expression beyond the limits from which most articles dealing with similar subjects have employed random sampling integration. Using a coaxial set-up in all cases, but with various relative dimensions of the right cylinder trunks (emitters and receivers), we have extracted fourfold definite integrals (with certain variable limits) giving the absolute and intrinsic efficiencies of which the ratios could be optimised by appropriate relative sizing of the right cylinder trunks (emission and detection).

45013 (CERN—84-15, pp 385-467) **Diagnostics.** Borer, J.; Jung, R. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

All the non interacting monitors used for the p-anti p instrumentation can be related to the use of the wall image current as induced by relativistic charged particle bunches circulating in a metallic pipe or vacuum chamber. The monitors are then classified by their type of beam coupling impedance. This allows a more generalized approach of the design of the so-called pickups.

45014 **(CERN-EP—85-50) Hardware processor for on-line event reconstruction.** Kostarakis, P.; Troester, D.A. (European Organization for Nuclear Research, Geneva (Switzerland)). 15 Apr 1985. 4p. (CONF-850152—14). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901955.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The measurement of CP violation using tagged K^0 and anti K^0 would lead to a very high initial reaction rate if a useful CP violation rate were achieved, owing to a neutral kaon production probability of 0.4% and to the CP violation parameters being typically 0.2%. The trigger set-up, including the hardware processor, is able to cope with 2×10^6 p anti p reactions per second. The initial rate is lowered to 5×10^3 events per second, containing 60% of the desired K^0/anti K^0 events. The dead-time is of the order of 10%, neglecting further data processing. We describe the proposed trigger logic for our experiment.

45015 **(FRNC-TH—1901) Dosimetry by stimulated exoelectronic emission of apatites and dental biomaterials.** Rakotomalala, R. (Toulouse-3 Univ., 31 (France)). Feb 1982. 107p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85751172.

This work is a contribution to the study of stimulated exoelectronic emission, the goal of which is the development of a dosimetry available in case of accidental irradiation. The first part is devoted to a review of the various theoretical models suggested by several authors on the exoemission phenomenon, and to the description of the experimental set up: counter and detector electronic circuits. The second part gives the experimental results obtained with the different products studied: fluorapatite, hydroxyapatite (considered to be the major constituent of bones and teeth), tricalcic phosphate and dental biomaterials: porcelain and some canal obturation substances.

45016 **(FRNC-TH—2013) Multiline digital radiographic imager study with synchronization to detector gas ion drift.** Peyret, O. (Institut National Polytechnique, 38 - Grenoble (France); Grenoble-1 Univ., 38 - La Tronche (France)). Jan 1985. 208p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752047.

This direct digital radiographic imager is based on X-ray detection in high pressure rare gas ionization chamber. This linear multidetector, from which scanning radiography is realized, records many lines together. Spatial resolution performance in scanning direction are made sure by scanning synchronization with ion drift in detector. After a physical study and a potential evaluation of its performances on mock-up, a 128 cell prototype has been realized. The first images give validation and limits of such a radiographic process.

45017 (INIS-mf—9710, pp 187-194) **Dual-channel spectral analyzer.** Prokop, K. (Jaderna Elektrarna, Dukovany (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A09/MF A01. File Number DE85781575. (CONF-8309348—).

From Diagnostics of nuclear power plant equipment national seminar; Zvikovske Podhradi, Czechoslovakia (28 Sep 1983).

The main component of the vibroacoustic diagnostic system for pressurized water reactor nuclear power plants is the spectral analyzer. Detailed technical specifications are given for two-channel spectral analyzers Hewlett-Packard (type 3582 A) and from Brueel and Kjaer (type 2034) based on fast Fourier transformation. (M.D.).

45018 **(IPNO-GEPL—83-10) High resolution spectrometry: how the analyzer and spectrometer performances and the beam emittance contribute to the results obtained.** Roussel, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 17p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751214.

Using first order calculations derived for an achromatic system A) (deltaxsub(F) / deltaEsub(i)=0) or an optimised system O) (xsub(F) minima). It is shown that the final resolution measured in the local plane of the spectrometer depends only on the emit-

tance of the accelerator and of the efficient area of the analyser exclusive of the properties of the spectrometer. The use of this result is only limited by higher order terms in the calculation or considerations out of this scope like target effects etc.

45019 **(LAL—84-01) Analysis and realization of a high resolution trigger for DM2 experiment.** Bertrand, J.L. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jan 1984. 252p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85751181.

The construction of a high resolution trigger has been carried out from its theoretical design to building. The term trigger is applied to an almost real-time system for track filtering in particle detection. Curved tracks are detected (with a magnetic field) and the detector is of a revolution symmetry type. The concept of a "hybrid" trigger with features in between those of the so-called "CELLO R0" and "MARK II" types is launched. It allows a positive versatility for the optimization of the different features. Besides a specific structure, some hardware and software implements have been designed for development and tests. The "TRIGGER LENT" is presently in operation in the DM2 experiment.

45020 **(LBL—91-Rev.-Suppl.) Major detectors in elementary particle physics. Supplement revision.** Gidal, G.; Armstrong, B.; Rittenberg, A. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016498.

This report is the second edition of a loose-leaf compendium of the properties and performance characteristics of the major detectors of elementary particle physics.

45021 **(MAFF-FRTR—77) Automatic sample changer for gamma spectrometry.** Andrews, D.J. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research). 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702019.

An automatic sample changer for gamma spectrometry is described which is designed for large-volume, low radioactivity environmental samples of various sizes up to maximum dimensions 100 mm diameter x 60 mm high. The sample changer is suitable for use with most existing gamma spectrometry systems which utilize GeLi or NaI detectors in vertical mode, in conjunction with a pulse height analyzer having auto-cycle and suitable data output facilities; it is linked to a Nuclear Data ND 6620 computer-based analysis system.

45022 **(MINTEK-M—172) Computer programmes for the control and data manipulation of a sequential x-ray-fluorescence spectrometer.** Spimpolo, G.F. (Council for Mineral Technology, Randburg (South Africa)). 19 Dec 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702042.

Two computer programmes have been written for use on a fully automated Siemens SRS200 sequential X-ray-fluorescence spectrometer. The first of these is used to control the spectrometer via an LC200 logic controller using a Data General Nova IV minicomputer; the second is used for the on-line evaluation of the intensity results and the printout of the analytical results. This system is an alternative to the systems offered by Siemens Ltd, which consist of a Process PR310 or Digital DEC PDP1103 computer and the Siemens Spectra 310 software package. The multibatch capabilities of the programmes, with the option of measuring one sample or a tray of samples before the results are calculated, give the new programmes a major advantage over the dedicated software and, together with the elimination of human error in calculation, have resulted in increased efficiency and quality in routine analyses. A description is given of the two programmes, as well as instruction and guidelines to the user.

45023 **(NIKHEF-H—84-10) Absolute calibration of the solid state detectors in the narrow band neutrino beam at CERN.** Abt, I.; Jongejans, B. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). 21 Sep 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702021.

Will be published in Nuclear Instruments and Methods in Physics Research.

A method to calibrate in an absolute way the solid state detectors that are used to monitor the muon flux in the (anti)neutrino beam line at the CERN SPS is described. This calibration is one way that opens the possibility to measure the (anti)neutrino flux needed for the determination of the absolute total cross-sections of (anti)neutrino nucleon interactions. Tracks of charged particles are recorded simultaneously in the solid state detectors and in Ilford G5 emulsions. The readings of the detectors are compared with a count of the tracks in the developed emulsions. Absolute calibration factors (number of passing muons per delivered pico-Coulomb of electric charge) under particular circumstances are given. The overall accuracy that can be obtained is 3%.

45024 **(PNL-SA—13271) Draft American National Standard N42.17A: performance specifications for health physics instrumentation.** Selby, J.M. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1984. Contract AC06-76RL01830. 9p. (CONF-850726—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016623.

From Workshop on radiation survey instruments and calibrations; Gaithersburg, MD, USA (10 Jul 1985).

The report describes the history of the development of the N42.17 standard on instrument performance, describes the standard itself and its relationship to other standards, and discusses ways the standards might be used on either a voluntary or semi-voluntary basis. (ACR)

45025 **(RI—170) Efficiency of neutron detection by the system of liquid scintillation counters. Calculation program for neutron transport with E < 20 MeV.** Daniehl', A.V.; Alkhazov, I.D.; Dushin, V.N.; Kovalenko, S.S.; Shpakov, V.I. (Radievyj Inst., Leningrad (USSR)). 1983. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702022.

The method for calculation of efficiency of neutron liquid scintillation counter systems is described by means of statistical simulation of registration process. The flowsheet of a computor code for calculating the efficiency is presented. The results of calculation for multi-parameter nuclear fission investigation are discussed. The system includes two counters of the type under consideration. Calculation data are compared with the experimental ones.

45026 **(Rijnhuizen—84-156) High transmission, 20-channel polychromator for the Thomson-scattering diagnostic of TORTUR 3.** Barth, C.J. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Jun 1984. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702020.

The Thomson-scattered spectra observed at the experiments TORTUR 2 and 3 show systematic deviations with respect to a gaussian profile. In order to study these spectra in more detail a 20-channel spectrometer has been designed and constructed to replace the present 10-channel apparatus. In the former instrument the analysed spectrum was directed to the photomultiplier by means of a fibre-optic array. The transmission of the new spectrometer has been increased by a factor 2.5 up to 45% by using wavelength selection mirrors instead of fibre optics. Electron temperatures and densities can be determined with a 5% error at values of 800 eV and 5 x 10^{19} m^{-3}. The detection limit of the diagnostic has been improved to nsub(e) approx. 3 x 10^{18} m^{-3} at Tsub(e) approx. 500 eV.

45027 **(Rijnhuizen—84-158) Design and construction of a mode converter from TE_{10}(rectangular) to TE_{11}(circular).** Tubbing, B.J.D. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Aug 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702023.

The design and manufacturing of a wavelength mode converter from the TE_{10} (rectangular) mode in oversized rectangular to the TE_{11} (circular) mode in oversized circular waveguide is described. A differential equation for the cross-sectional shape of the converter was solved numerically. A stainless-steel mandrel was

produced on a numerically controlled milling machine. Sixteen converters were produced by means of electroforming on one mandrel.

45028 **(SI—83-19) Gas scintillation drift chamber for heavy ion detection.** Mathis, K.D.; Simon, M.; Henkel, M. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). 1983. 22p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

A gas scintillation drift chamber has been exposed to the heavy ion beam at Berkeley, Ca, USA. The drift velocity of an Ar (98%) -N_2 (2%) gas mixture as a function of the reduced electric field has been measured. The detector provided a spatial resolution of 500 μm and an energy resolution of 6% for penetrating 518 MeV/nuc. Fe-particles.

45029 **(SI—84-2) Automatic measuring system for particle tracks in plastic detectors.** Trakowski, W.; Schoefer, B.; Dreute, J.; Sonntag, S.; Brechtmann, C.; Beer, J.; Drechsel, H.; Heinrich, W. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). 1984. 24p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

In the last few years picture analysis methods evolved into a powerful technique for measurements of nuclear tracks in plastic detectors. We developed a microprocessor based picture analysis system for automatic track measurements. The video pictures of particle tracks seen through a microscope are digitized in real time and the picture analysis is done by software. The microscope is equipped with a stage driven by stepping motors, which are controlled by a separate microprocessor. A PDP 11/23 supervises the operation of all microprocessors and stores the measured data on its mass storage devices. This paper describes the hard- and software of the system and the methods of picture analysis which are used for the track identification and measurement.

45030 **Magnetic monopole detectors based on He(2^3S).** Hurst, G.S.; Jones, H.W.; Thomson, J.O.; Wunderlich, R. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] A: General Physics;* **32**: No. 3, 1875-1877(Sep 1985). Contract AC05-84OR21400.

Magnetic monopole detectors based on the premise that these particles can create the triplet metastable state in helium, He(2^3S), exclusively and without ionization are believed to be feasible. In one of these, He(2^3S) is detected in an ionization chamber array using both pure helium and a mixture of He+N_2 in which Penning ionization occurs. In the second version, resonance ionization spectroscopy is used to selectively ionize He(2^3S). In both cases, monopoles with velocities greater than 10^{-4}c can be searched for with both large and reliable detectors.

45031 **Superconductive detectors.** Barone, A. (Consiglio Nazionale delle Ricerche, Arco Felice (Italy). Lab. di Cibernetica; Naples Univ. (Italy). Ist. di Fisica); De Stefano, S. (Naples Univ. (Italy). Ist. di Fisica); Gray, K.E. (Argonne National Lab., IL (USA)). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **235**: No. 2, 254-265(1 Apr 1985). (CONF-8405241—).

From Seminar on perspectives for experimental apparatus at future high energy machines; Florence, Italy (21 May 1984).

Various attempts to use superconductors in the field of radiation detection are reviewed with particular emphasis on the stimulating perspectives offered by superconducting tunnel devices. Applications in the context of energy spectroscopy as well as in the fast discrimination are discussed in the light of recent results. In this framework the central role of nonequilibrium state of superconductors is analyzed in some detail.

45032 **Semiconductor drift chambers for position and energy measurements.** Rehak, P. (Brookhaven National Lab., Upton, NY (USA)); Gatti, E.; Longoni, A. (Politecnico di Milano (Italy). Ist. di Elettronica); Kemmer, J. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik); Holl, P.; Klanner, R.; Lutz, G.; Wylie, A. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **235**: No. 2, 224-234(1 Apr 1985). (CONF-8405241—). Contract AC02-76CH00016.

From Seminar on perspectives for experimental apparatus at future high energy machines; Florence, Italy (21 May 1984).

Semiconductor drift chambers have been recently suggested and feasibility tests performed. This paper presents the first operative silicon drift detectors for position and energy measurements. Design criteria and experimental results in the laboratory and on an accelerator beam are reported.

45033 **Forward spectrometer of the Fermilab colliding detector facility.** McIntyre, P. (Texas A & M Univ., College Station). *AIP (American Institute of Physics) Conference Proceedings;* No. 85, 263-270(1982). (CONF-811231—).

From Forward collider workshop; Madison, WI, USA (10 Dec 1981).

The CDF forward spectrometer is described. It is designed to extend analysis of secondaries in anti pp collisions down to an angle of 2°. New particle production is expected to concentrate in the forward direction for radical $\sqrt{s}$ = 2 TeV collisions. Several novel aspects of the CDF forward spectrometer are described.

45034 **Saturated avalanche calorimeter.** Atac, M.; Kim, S.; Mishina, M.; Chinowsky, W.; Ely, R.; Gold, M.; Kadyk, J.; Rowson, P.; Shinsky, K.; Wong, Y. (Fermi National Accelerator Lab., Batavia, IL). *AIP (American Institute of Physics) Conference Proceedings;* No. 85, 284-317(1982). (CONF-811231—).

From Forward collider workshop; Madison, WI, USA (10 Dec 1981).

A gas sampling electromagnetic calorimeter running in a Saturated Avalanche Mode was tested at SLAC with positrons incident at energy up to 17.5 GeV. With this new method, good energy resolution, 16%/$\sqrt{E}$, and good linearity were obtained with arrays of 34 0.5 radiation length thick lead plates interleaved with 34 wire counters. There was no measurable systematic effect. Amplifiers are not needed; the signals are large enough to be connected directly to the ADC's.

45035 **Forward detector for the DO area at Fermilab.** Longo, M.J. (Univ. of Michigan, Ann Arbor). *AIP (American Institute of Physics) Conference Proceedings;* No. 85, 318-324(1982). (CONF-811231—).

From Forward collider workshop; Madison, WI, USA (10 Dec 1981).

About 90% of the energy from a $\sqrt{s}$ = 2000 GeV anti pp collision goes out at angles <2° in the laboratory. We propose a detector for the DO area which emphasizes tracking and calorimetry down to the smallest practical angles. A detector of this type is essential for studying the general features of collisions at Collider energies, particularly the energy flow, multiplicity and inelastic cross section. It will also play a very important role in selecting hard collisions which will reduce the background for new physics in a central detector.

45036 **Early results from experiment UA1 at the CERN anti pp collider.** Kernan, A. (Univ. of California, Riverside). *AIP (American Institute of Physics) Conference Proceedings;* No. 85, 325-346(1982). (CONF-811231—).

From Forward collider workshop; Madison, WI, USA (10 Dec 1981).

The UA1 detector is a general purpose 4π apparatus for the measurement of hadron and lepton momenta at anti pp collider energies. The performance of the detector and first results from 1981 running are discussed.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

45037 Measuring transient radiation effects in optical fibers. Rotter, M.D.; Jander, D.R. (Lawrence Livermore National Lab., CA). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* 506: 18-21(1984). Contract W-7405-ENG-48.

A new method is proposed for measuring transient radiation effects in optical fibers on a nanosecond timescale. The method, which incorporates a streak camera, allows more precise time resolution than other methods and has the advantage of measuring the radiation-induced attenuation as a function of wavelength and time simultaneously. By choosing different light sources and sweep speeds, radiation-induced attenuation may be measured under a variety of experimental configurations. Examples of the types of output obtained with our method are given. 4 references, 6 figures.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 43641, 43751, 44076, 44379, 44879, 44908, 44913, 45070, 45102

45038 (AD-A—153636/6/XAB) Design consideration for the x-ray Cherenkov experiment. Master's thesis. Choi, Y.D. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1984. 50p. NTIS, PC A03/MF A01.

The feasibility of measuring Cherenkov radiation in the x-ray region was investigated. It is found that the experimental measurement of x-ray Cherenkov radiation is possible for the carbon K (283.84 eV), aluminum L1 (87.01 eV) and L2,3 (72.78 eV) absorption-edges. Measurement in the aluminum K (1559.9 eV) absorption edge region was found to be not possible since the real part of the index of refraction did not exceed unity. The relative power from Cherenkov radiation was calculated for the three possible cases and count-rate estimates were given. The experimental apparatus for the measurement of X-ray Cerenkov radiation was redesigned to allow measurement of the carbon K edge and aluminum L1 edge. An experiment was attempted, but not completed due to the failure of a necessary preamplifier for a proportional counter. New design considerations are presented and incorporated changes to avoid the experimental shortcomings of previous measurements.

45039 (AD-A—154533/4/XAB) Observations of the use of the Setapoint detector. Technical note. Coleman, J.R.; Gallop, L.D. (Defence Research Establishment, Ottawa, Ontario (Canada)). Dec 1984. 16p. (In French). (DREO-TN—84-33). NTIS, PC A02/MF A01.

In a previous investigation, a variety of tests were used to study the low-temperature flow behaviour of aviation-turbine fuels. These included both specification fuels, and others that had higher-than-usual freeze points, but whose use might become necessary in the future. One procedure employed the Setapoint detector, manufactured by Stanhope Seta Ltd. This device measures the resistance to passage of a fuel pumped back and forth across a screen during a programmed cooling regime. In an attempt to find the reason for certain abnormal test results obtained using the Setapoint detector, a review of experimental results was conducted. Visual observations made during the tests were considered in conjunction with the stop flow and flow points. A number of distinct modes of behaviour, some leading to aberrant results, were identified. The instrument appeared best suited to specification aviation fuels, and middle distillates that produce fine homogeneous wax deposits during the test.

45040 (BDX—613-3269) Evaluation of robot-aided ultrasonic thickness measurement. Lembke, J.R. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Aug 1985. Contract AC04-76DP00613. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016936.

Wall thickness can be measured ultrasonically and usually this is performed by manually placing a probe at various locations on the outer contour of a part. This operation requires a high degree of operator skill because the probe must be positioned precisely and placed normal to the part surface for accurate measurements. As a means of automating the measurement process and minimizing the effects of human variability, robot placement of the ultrasonic probe was evaluated. With an appropriate adapter, a robot was used to move the probe to several positions on a part, and repeated thickness measurements were made at each location. The standard deviation of the thickness measurement was estimated to be 0.032 percent (maximum) of the measured wall thickness, with 95 percent confidence. This includes the variability of the measurement device as well as the variability of probe placement. Based on this experiment, the robot was judged to be capable of performing the ultrasonic thickness measurements.

45041 (CAPE—2954) Survey and alignment liquid level MKIII (Engineering Materials). (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 8 Dec 1981. Contract AC03-76SF00515. H. File Number TI85016159.

These drawings provide engineering details on components of a liquid level apparatus useful in survey and alignment procedures in visually obstructed areas.

45042 (CEA-CONF—7595) Performances of a picosecond streak camera used in conjunction with a photodiode array measuring system. Cavailler, C.; Fleurot, N.; Mens, A.; Knispel, G.; Miehe, J.A. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1984. 14p. (CONF-8409239—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752045.

From 8. symposium on photoelectronics images devices; London, UK (5 Sep 1984).

The electronics associated with a linear array of 1024 photodiodes is described. Special emphasis is devoted to the characteristics of the low noise charge sensitive preamplifier: using an analog-digital converter of 12 bits, the overall signal to noise ratio is about 4×10^3 and the effective dynamic range is evaluated at approximately 10^3. Test measurements are carried out with an S1 picosecond streak camera using a YAG laser beam. This system is now being used on our high power OCTAL laser to study the temporal laser pulse shape; the relevant measurements will be presented.

45043 (FRNC-TH—1462) Contribution to time resolved X-ray fluence and differential spectra measurement method improvement in 5-200 KeV range. Application to pulsed emission sources. Vie, M. (Toulouse-3 Univ., 31 (France)). Sep 1983. 187p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751176.

Two types of sensors have been developed to measure locally the time-resolved fluence and differential energetic spectrum of pulsed X-ray in the energy range 5 to 200 keV. Rise time of these sensors is very short (10 ns) in order to permit time-resolved measurements. Fluence sensors have been developed by putting filters in front of detector in order to make sensor response independent of X-ray energy and proportional to X-ray fluence. The energetic differential spectrum was calculated by way of a method similar to the ROSS method but using filters separated within a pair defining adjacent spectral width. A detailed analysis of uncertainties affecting calculated fluence and spectrum has been done.

45044 (LA-UR—85-2743) Shuttering efficiencies of nanosecond-gated photoemissive shutter tubes. Yates, G.J.; Jaramillo, S.A.; Pagano, T.S.; Black, J.P. (Los Alamos National Lab., NM (USA); EG and G, Inc., Albuquerque, NM (USA). Kirtland Operations). 1985. Contract W-7405-ENG-36. 9p. (CONF-850887—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015728.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Recent studies show that effective shuttering of photoemissive tubes, such as Silicon-Intensified-Target Vidicons (SITVs) and Microchannel-plate Image Intensifier Tubes (MCPTs), can vary widely depending upon the extent of their opacity to an input flux of photons. Optical feedthrough signals from photon transmission through the photocathode to the target or phosphor ranging from 10^{-4} to 10^{-9} (when compared with gated signals) were measured for a large sampling of commercially available units. Effective shutter ratios of 10^6 to 10^9 measured for units operated in quiescently

dark environments can be substantially reduced by optical feedthrough. Furthermore, ineffective suppression of photoemission can cause further reductions in shutter ratio. Reductions are roughly correlated with the ratio of optical gate duration to light pulse duration. Experimentation with various thicknesses of aluminum depositions on MCPT phosphors and chromium layering on SITV silicon targets indicate substantial reductions (2x to 15x) in transmission with minimal increases in threshold voltages required for gain. These results, together with exploratory studies of external coating of output fiber optics with transmission filters spectrally matched to minimize feedthrough to P-20 phosphors are reported. 4 refs., 13 figs., 3 tabs.

45045 **(PB—85-195980) Radiometry using synchrotron radiation. Final report.** Saloman, E.B.; Ebner, S.C.; Hughey, L.R. (National Bureau of Standards, Washington, DC (USA)). 1981. 8p. (CONF-8104104—). Published in Proceedings of the SPIE 279, Washington, DC, April 21-22, 1981, p76-83.

From SPIE technical symposium; Washington, DC, USA (20 Apr 1981).

Sponsored by SPIE-The International Society for Optical Engineering, Bellingham, WA.

Synchrotron radiation is a source of continuum radiation ranging from the x-ray or soft x-ray region (depending on machine energy) to beyond the visible region. The amount of radiation emitted is a calculable function of machine operating parameters. This makes it possible to use synchrotron radiation from electron synchrotrons and electron storage rings as an absolute source particularly in the VUV and soft x-ray regions where other standards are difficult to find. At the National Bureau of Standards (NBS) an electron storage ring (SURF-II) has been used to calibrate spectrometers and photometers used in solar and aeronomy research and in fusion plasma diagnostics. A large chamber has recently been completed to facilitate such calibrations. The radiation incident on these spectrometers can be calculated to uncertainties of 3%. A technique to exactly determine the number of electrons orbiting in the ring is currently being developed to reduce this uncertainty.

45046 (SAND—84-0288, pp 118) **High temperature solid-state devices.** Zipperian, T.E.; Dawson, L.R. (Sandia National Labs., Albuquerque, NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—). Contract AC04-76DP00789.

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45047 **(UCRL—92414) Ultimate limits of FT-IR.** Hirschfeld, T. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 9p. (CONF-8506118—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016442.

From International conference on Fourier and computerized infrared spectroscopy; Ottawa, Canada (24 Jun 1985).

Continual improvements in FT-IR have brought us within two ordrs of magnitude of the theoretical limits of the technology, set by the intrinsic noise of the blackbody spectrum. Further improvements in the technology still require further optimization by step-by-step comparison between actual components performance and their theoretical limit. Among insights from such a process, we have found a surprisingly low energy efficiency in current interferometers, substantial amounts of excess noise in the detectors and nonlinearity in their amplifiers, and an insufficient utilization of the very low aberration levels of interferometers. Beyond this, substantial improvements in spectroscopic sensitivity can be achieved by appropriate choice of the optical interaction. Here the elimination of the 100% line is a particularly desirable goal. The optics of sampling accessories also merit much attention, including throughput matching (and also throughput conservation), optimizing interaction strength, signal strength and detector noise optimization, etc. Finally, data processing can be used to substantially improve the performance capabilities of FT-IR, particularly if we willing to depart from the conventional data presentations used in IR spectroscopy. 8 figs., 1 tab.

45048 **Fixed point theory of iterative excitation schemes in NMR.** Tycko, R.; Pines, A.; Guckenheimer, J. (Department of Chemistry, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **83**: No. 6, 2775-2802(15 Sep 1985).

Iterative schemes for NMR have been developed by several groups. A theoretical framework based on mathematical dynamics is described for such iterative schemes in nonlinear NMR excitation. This is applicable to any system subjected to coherent radiation or other experimentally controllable external forces. The effect of the excitation, usually a pulse sequence, can be summarized by a propagator or superpropagator (U). The iterative scheme (F) is regarded as a map of propagator space into itself, U/sub n/ +1 = FU/sub n/. One designs maps for which a particular propagator U-bar or set of propagators {U-bar} is a fixed point or invariant set. The stability of the fixed points along various directions is characterized by linearizing F around the fixed point, in analogy to the evaluation of an average Hamiltonian. Stable directions of fixed points typically give rise to broadband behavior (in parameters such as frequency, rf amplitude, or coupling constants) and unstable directions to narrowband behavior. The dynamics of the maps are illustrated by "basin images" which depict the convergence of points in propagator space to the stable fixed points. The basin images facilitate the optimal selection of initial pulse sequences to ensure convergence to a desired excitation. Extensions to iterative schemes with several fixed points are discussed. Maps are shown for the propagator space SO(3) appropriate to iterative schemes for isolated spins or two-level systems. Some maps exhibit smooth, continuous dynamics whereas others have basin images with complex and fractal structures.

45049 **Flow metering valve.** Blaedel, K.L. (to Dept. of Energy). US Patent 4,505,287. 19 Mar 1985. Filed date 3 Nov 1983. vp.

PAT-APPL-548280.

An apparatus for metering fluids at high pressures of about 20,000 to 60,000 psi is disclosed. The apparatus includes first and second plates which are positioned adjacent each other to form a valve chamber. The plates are made of materials which have substantially equal elastic properties. One plate has a planar surface area, and the other a recessed surface area defined by periphery and central lips. When the two plates are positioned in adjacent contacting relationship, A valve chamber is formed between the planar surface area and the recessed surface area. Fluid is introduced into the chamber and exits therefrom when a deformation occurs at positions where they no longer form a valve seat. This permits the metering of fluids at high pressures and at slow variable rates. Fluid then exits from the chamber until an applied external force becomes large enough to bring the valve seats back into contact.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 44126

45050 **(GKSS—85/E/5) Novel random-pulser concept for empirical reliability studies of complex systems.** Priesmeyer, H.G. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752088.

The concept of a computer-controlled pseudo-random pulser is described, which is able to produce pulse sequences obeying statistical distributions, used in probability assessments of safety technology. It shall be used in empirical investigations of the reliability of complex systems.

45 EXPLOSIONS AND EXPLOSIVES

45051 (SAND—85-1166) Six degree of freedom simulation of fluid payload projectiles using numerically computed fluid moments. Vaughn, H.R.; Wolfe, W.P.; Oberkampf, W.L. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1985. Contract AC04-76DP00789. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85017183.

A flight trajectory simulation method has been developed for calculating the six degree of freedom motion of fluid filled projectiles. Numerically calculated internal fluid moments and experimentally known aerodynamic forces and moments are coupled to the projectile motion. Comparisons of predicted results with flight test data of an M483 155mm artillery projectile with a highly viscous payload confirm the accuracy of the simulation. This simulation clearly shows that the flight instability is due to the growth of the nutation component of angular motion caused by the viscous effects of the fluid payload. This simulation procedure, when used in conjunction with the previously developed method for calculating internal fluid moments, allows the designer to examine the effects of various liquid payloads and container geometries on the dynamic behavior of flight vehicles.

4501 Chemical

REFER ALSO TO CITATION(S) 45306, 45308

45052 (AD-A—155033/4/XAB) Target vulnerability to air defense weapons. Master's thesis. Reinard, B.E. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1984. 149p. NTIS, PC A07/MF A01.

This thesis is intended to become a portion of the textbook utilized in the course entitled Warheads and Lethality (AE-3705). This portion of the text includes an unclassified discussion of a target's susceptibility to an externally detonating HE warhead and a target's vulnerability. In particular, the section on target susceptibility leads to the development of the number of fragments which strike a target aircraft from an externally detonating warhead. The section on target vulnerability explains the methodology used for identifying critical components and conducting a vulnerability assessment, and leads to the effects of fragments and penetrators striking an aircraft.

45053 (LA-UR—85-2373) Guidelines for a thermochemical kinetics computer program. Janney, J.L.; Rogers, R.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-8509144—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015671.

From 14. North American Thermal Analysis Society conference (NATAS); San Francisco, CA, USA (1 Sep 1985).

Guidelines are given for an interactive computer program that will analyze thermochemical decomposition rate data obtained by isothermal differential-scanning calorimetry. Data from any portion of the rate curve may be analyzed, and either normal or autocatalytic rate laws may be used. The computer calculates and displays normalized data listings, rate curves, order plots, and autocatalytic rate law plots. It calculates rate constants by linear regression treatment of data from curve segments chosen by the user. Many options are available, and many forms of the rate laws may be selected. This program was designed primarily for research rather than routine use. 6 figs.

45054 (MLM—3280(OP)) Component Test Facility. Allison, J.L. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 9p. (CONF-8506117—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016445.

From 41. meeting of the IMOG subgroup on environmental testing; Miamisburg, OH, USA (18 Jun 1985).

Mound's Component Test Facility Project is a $21.3M expansion and modernization of the present testing facility. A new, single-story building of approximately 32,000 sq ft is being built for systems that destructively test weapons components from development and production programs at Mound. It will house three large test cells (14.5 ft in diameter by 24 ft in length) and will provide space for additional, smaller, self-contained testers. The new structure will also provide space for test system fabrication, a standards calibration laboratory, and equipment maintenance, as well as areas for administrative and engineering functions. Figures 1-4 show preparations being made for the new facility. Approximately half of the $21.3M budgeted for the project is for the testing systems themselves. High-speed camera test systems will be designed, fabricated, and installed over a 5-yr period. The test system design was begun in January 1983, and the final test system will be installed and operational in July 1988.

45055 (SAND—84-1605C) Spectroscopic studies of detonating heterogeneous explosives. Renlund, A.M.; Trott, W.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 10p. (CONF-851038—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85007687.

From DEA-AF-71-F/G-7304 physics of explosives technical meeting; Albuquerque, NM, USA (17 Oct 1985).

The experimental objectives of this work are to use real-time spectroscopic techniques, emission spectroscopy and Raman spectra to monitor chemical and physical changes in shock-loaded or detonating high explosive (HE) samples. The investigators hope to identify chemical species including any transient intermediates. Also, they wish to determine the physical state of the material when the reactions are taking place; measure the temperature and the pressure; and study the effect of different initiation parameters and bulk properties of the explosive material. This work is just part of the effort undertaken to gain information on the detailed chemistry involved in initiation and detonation. In summary, the investigators have obtained vibrational temperatures of some small radical products of detonation, which may correlate with the detonation temperature. They have also observed that NO_2 is an early product from detonating HNS and RDX, and that other electronically excited radical species such as CN(B) are formed in HNS detonations. In the Raman work, the single-pulse spectra could be obtained even in the severe environment of a detonation, and that the rate of removal of the parent molecule could be monitored. 2 refs., 6 figs.

45056 (SAND—85-0397C) Modeling and computation of deflagration-to-detonation transition in reactive granular materials. Baer, M.R.; Benner, R.E.; Gross, R.J.; Nunziato, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 31p. (CONF-8506169—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016160.

From 17. AMS-SIAM summer seminar in applied mathematics; Ithaca, NY, USA (30 Jun 1985).

In this paper, we present a multiphase flow model of the combustion of a gas-permeable reactive granular material. In particular, we focus on a model of the physical-chemical processes associated with the transition from deflagration to detonation in granular explosives and propellants. Two numerical strategies are discussed that are aimed toward multidimensional computations. Comparison of our results with experimental data for the explosives CP and HMX suggests that a thermodynamically consistent model can describe the flame spread processes associated with convective burning, compressive deflagration, and detonation.

45057 (SAND—85-0642C) Pore fluid migration model for stress cage decay. Wilson, R.K. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850953—1). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. File Number DE85016998.

From 3. symposium on containment of underground nuclear explosions; Idaho Falls, ID, USA (10 Sep 1985).

A series of calculations have been completed to investigate pore fluid migration as a mechanism for stress cage decay. The model is based on the one-dimensional (spherical), isothermal flow of a compressible fluid in a saturated porous medium with constant permeability and porosity. The initial pore pressure distribution is assumed to be proportional to the residual mean stress in the rock following cavity formation. Predicted pore pressure decay compares favorably to measured long-term stress decay data from the ONETON event. Flow calculations also compare well to the measured accumulation of water in an open drift near the cavity. In ad-

dition to developing a capability to predict stress cage decay, these calculations also provide insight to the behavior of the rock at the edge of the cavity. 6 figs., 2 tabs.

45058 **(SAND—85-0785C) Stress-wave calculations of two containment experiments.** Drumheller, D.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 18p. (CONF-850953—2). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. File Number DE85017050.

From 3. symposium on containment of underground nuclear explosions; Idaho Falls, ID, USA (10 Sep 1985).

Accurate constitutive models for geological materials are central to prediction of stress-wave effects produced by underground explosions. Unlike many stress-wave problems which require only a uniaxial-strain characterization, the computation of residual-stress fields in containment problems requires a three-dimensional material model. These models are usually complicated, since the effects of water content, porosity, and yielding are important. This paper describes a material model for an ashfall tuff which was subjected to stress-wave loading by detonation of conventional explosive. A significant advantage of this model is that the constitutive parameters are determined primarily from laboratory data obtained on cored samples from the field test site. Stress-wave calculations are compared to the data from two field tests in which 64-pound and 2000-pound spherical charges of TNT were used. 9 refs., 12 figs., 1 tab.

45059 **(SAND—85-1545C) Theoretical equations of state for the detonation products of explosives.** Kerley, G.I. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850706—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014700.

From 8. international symposium on detonation; Albuquerque, NM, USA (15 Jul 1985).

Equations of state (EOS) for the detonation products of explosives are calculated from EOS for the individual chemical species, using the approximation of ideal mixing. The theory is applied to 15 explosives of varying composition and loading density. To understand these explosives, it is necessary to identify the important reaction products and to determine their EOS parameters. For explosives that contain no carbon or are oxygen-rich, the principal species and their EOS are known reasonably well, and the theory gives good results. For carbon-rich explosives, it is found that formic acid competes with carbon as a reaction product. If formic acid is omitted from the equilibrium, the data for PETN and RDX cannot be fit with any reasonable modification to the carbon EOS. An EOS for formic acid is constructed, and the theory gives good results for all classes of CHNO explosives. 21 refs, 6 figs, 1 tab.

4502 Nuclear

REFER ALSO TO CITATION(S) 43881, 44830, 45118, 45306

45060 **(AD—355326/0/XAB) D-region physical chemistry.** Berning, W.W. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). 27 Nov 1964. 502p. NTIS, PC A22/MF A01.

Report on Operation Dominic. Fish Bowl Series. Proj. 6.3.

Contents include Appendix B, Rocket Vehicle Performance Introduction, Trajectory parameters, Trajectory solutions, Results, Discussion; and Appendix C Propagation Experiment: Instrumentation and Performance - Ground instrumentation and performance, 3-frequency experiment ground instrumentation, Satellite experiment ground instrumentation, GMD telemetry and tracking ground instrumentation, Rocket instrumentation and performance - 3-frequency experiment rocket instrumentation, GMD rocket instrumentation, Rocket dispersive doppler, Starfish Event, Blue-gill Event, Kingfish Event, Signal duration and strength - Signal-duration graphs, Signal-strength graphs.

45061 **(AD-A—154945/0/XAB) Some policy implications of nuclear winter.** Gertler, J.J. (RAND Corp., Santa Monica, CA (USA)). Jan 1985. 19p. (RAND-P—7045). NTIS, PC A02/MF A01.

The theory of nuclear winter has had as checkered a history as any new idea since Darwin published The Origin of Species. There have been questions of its scientific validity, reviews both laudatory and damning, pleas for arms reductions, hosannahs for a newfound hope that nuclear war has at least been rendered completely unthinkable, and frustration that two generations of human toil in weapons laboratories and think tanks have been rendered by a natural doomsday machine. Some have even suggested that nuclear winter might be used as an offensive weapon. Disturbingly, a substantial number of commentators have concluded that nuclear winter carries no immediate implications for policy, because to their way of thinking, nuclear winter is a (a) just one more of the many undesirable effects of nuclear war; (b) the ulimate deterrent to nuclear use, and therefore should be welcomed rather than compensated for; or (c) an unproven theory, meaning that consideration of policy questions is premature. Those who overlook the policy questions are following a dangerous path. The nuclear winter theory contains serious short- and long-term implications for United States foreign and strategic policy. Although the theory may never be confirmed or refuted, discussion of these policy questions should begin now because many of the potential effects of nuclear winter - particularly in foreign policy - will come about regardless of whether or not the phenomenon can actually exist.

45062 **(AD-A—155068/0/XAB) High-altitude NuDet phenomenology. Quarterly report, 1 February 1985-30 April 1985.** McCartor, T.H. (Mission Research Corp., Santa Barbara, CA (USA)). May 1985. 5p. NTIS, PC A02/MF A01.

The author continued to generate a data base of optical signals (at a variety of wavelengths). These simulated optical signals depend on both the burst-point density and on weapon parameters. This quarter he completed the 1-, 100-, 1000-, and 10000-kt simulations for all altitudes. From these simulations, he generated optical signals in the silicon, S_4, visible, thermal, blue, green, red, broadband, and narrow infrared bandpasses. He made the MODEL3 code operational on the ELXSI computer at MRC and successfully completed a 100-kt simulation at 82 km. However, at this time, the MODEL3 code is far from being run in a production mode. Plans are to on make MODEL3 runs to check the RADFLO results at 82 km. John Zinn's scaling laws were also applied for estimating the yield of a nuclear detonation from critical times (t sub 1MAX, t sub MIN, t sub 2MAX) in the optical pulse to the RADFLO simulated data base. The Zinn scaling relationships for the visible and silicon responses were designed from low-altitude data bases and the scaling laws produce large errors. However, Zinn's scaling rules for the S_4 detector explicitly include burst-point density and his S_4 scaling relationships accurately estimates the yield up to an altitude of approximately 30 km (until the minimum in the optical signal disappears).

45063 **(AD-A—995235/9/XAB) Initial gamma data from nuclear-weapon tests 1948 through 1962.** Smith, R.J.; Benck, R.E.; Lissak, E.E. (Army Nuclear Effects Lab., Edgewood Arsenal, MD (USA)). 1 Jun 1984. 236p. (NDL-TR—53(EX)). NTIS, PC A11/MF A01.

45064 **(AD-A—995239/1/XAB) Operation Crossroads official report, Task Unit 1.52.** (Task Unit 1.52, APO San Francisco, CA (USA)). 1945. 152p. NTIS, PC A08/MF A01.

The report of the Army Air Forces' photographic coverage of the world's fourth and fifth atomic bombs tests at Bikini Atoll is better told by the Motion Picture TASK GROUP ONE POINT FIVE, or by perusal of the 6,000 still photographs on file. This report present facts and figures accumulated during seven months of preparation for two tests and two days operation, in the hope that it may acquaint the planner of future missions with some of the factors involved. This report contain brief narrative and technical reports, a Film catalogue, and many photographs taken during Crossroads Operation.

45065 **(AD-A—995241/7/XAB) Report of Project 1-M-54 on thirty service men exposed to residual radiation at Operation castle.** (Joint Task Force 132, Washington, DC (USA)). 1 Aug 1984. 55p. NTIS, PC A04/MF A01.

Extracted version of report dated 5 Jul 54.

This 1954 report is part of the NTPR (Nuclear Test Personnel Review) Program. Following the detonation at Bikini Atoll, thirty service men who had been exposed to debris from the 1 March detonation were returned to Tripler Army Hospital at Honolulu where the Tripler facilities and professional staff could be used. The clinical observations on the thirty patients were completed by 15 May and the patients were discharged to duty on 17 May. Special emphasis was placed upon examination of the lens of the eyes so as to establish a firm base-line to aid in the evaluation.

45066 **(AD-A—995283/9/XAB) Radioactive contamination of ventilation supply system, USS Crittenden, from Baker Explosion, Operation Crossroads. Final report.** Holden, F.R.; Skow, R.K.; Owings, A.F.; Evans, E.C.; Worsham, M.L. (Naval Radiological Defense Lab., San Francisco, CA (USA)). 14 Feb 1950. 39p. (USNRDL—551). NTIS, PC A03/MF A01.

Dust in the ventilation system of the after-engine room of the USS Crittenden was contaminated by the base surge from the Baker explosion at Operation Crossroads. Although all ventilation system openings on target ships were sealed prior to the Baker explosion, there was damage to the cover on the system for the after-engine room of the USS Crittenden. The damage to the cover consisted of an opening approximately six square inches in area. The dust in the contaminated ventilation system was recovered and the amount and composition of the radioactive constituents were measured. The radioactive contamination as a funciton of particle size of the dust was also determined. One and one half years after the Baker explosion, fission products equivalent to 115 microcuries of radioactivity were recovered from the dust. It was calculated from radiochemical analysis and fission product decay schemes that approximately 370 curies entered the ventilation system from the base surge. The corresponding alpha activity was 0.43 microcurie. It was also found that 18% of the dust by weight was of respirable particle sizes (less than five microns) and that it carried about 160 curies of the total radioactivity.

45067 **(SAND—85-0222) EMP-induced, time-domain grazing solution for an infinite wire over the ground.** Chen, K.C.; Damrau, K.M. (Sandia National Labs., Albuquerque, NM (USA)). May 1985. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017298.

The EMP-induced, time-domain current waveform is obtained for an infinite wire over the ground under grazing incidence. In contrast to previous results, the maximum grazing current is found to be slightly larger when the ground conductivity is higher. Also, the grazing angle for maximum current is found to be smaller when the ground conductivity is higher. For a ground conductivity of 10^{-2}S/m, the maximum current is approximately a factor of five larger than typical value reported in the literature. A byproduct of this study is a simple formula of ground inductance for the transmission line mode.

45068 **(UCRL—53545) Calculating the vulnerability of synthetic polymers to autoignition during nuclear flash. Final report.** Hickman, R.; Reitter, T. (Lawrence Livermore National Lab., CA (USA)). 1985. 31p. NTIS, PC A03/MF A01. File Number DE85016649.

The purpose of our investigation was to determine if the rapid progression of fire to flashover conditions in a furnished room, observed in a 1953 nuclear weapons test at the Nevada Test Site (the Encore Event), might be typical behavior rather than an aberration. If flashover under such conditions is indeed likely, this phenomenon is worth pursuing in view of the increased threat to buildings and human life from possible large-scale fires. We placed special emphasis on fires that occurred in modern rooms, i.e., ones furnished with upholstery and drapery materials made from synthetic polymers. Examination of photochemical processes showed them to be an unlikely explanation, either in Encore or in the future. Our calculation of rapid radiant-heating behavior of a few materials demonstrated that fabrics and fabric-covered foams would exceed their autoignition temperature when exposed to a 25-cal/cm^2 fluence from a 1-Mt air burst weapon. Because synthetic polymers have higher heating values and release heat faster during combustion than do the cellulosics used in the Encore experiment, early flashover should not be unexpected in contemporary households. However, the far-field thermal fluence required would be higher because of the absorption of thermal energy by windows and window coverings. Because of the complexity of the problem, carefully planned, full-scale experiments will be needed to finally answer the question. 39 refs., 9 figs., 8 tabs.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 45305

45069 **(AD-A—153795/0/XAB) Low-frequency spectral minimum in underground explosion P spectra. Technical report, November 1982-November 1983.** Smart, G. (Teledyne Geotech, Alexandria, VA (USA)). 12 Jan 1984. 57p. NTIS, PC A04/MF A01.

We confirm that a very low frequency discriminant, i.e., the hole due to pP interference, located at the lower extreme of underground nuclear explosion spectra, is preserved in short-period seismic recordings. This is shown repeatedly, from subarray to subarray, in comparisons of (Amchitka Test) LONGSHOT with a control earthquake, in recordings of those events made at LASA. The discriminant, previously neglected as falling outside seismometer spectral range, is available with present recording systems. To isolate the pP effect for observation, the explosion spectra are, in effect, divided by the spectra of the control earthquake, removing interference of earth and instrument responses. It is not clear whether use of a control earthquake is unavoidable.

45070 (EGG/10282—1057, pp 14.1-14.12) **Electronic Pinex: the acquisition of nuclear weapons images in underground detonations.** Sammons, T.J. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The EG and G/EM Reticon 100X100 photodiode array and its use in the Electronic Pinex measurement are described, and the high-speed optical gating system and its capabilities are detailed. Also discussed are the data transport and memory systems used to acquire and store the image in the field trailer.

45071 (EGG/10282—1057, pp 24.1-24.15) **Remote sensing of traveling ionospheric disturbances resulting from underground nuclear tests.** Copenhaver, C. (EG and G Energy Measurements Inc., Los Alamos, NM). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Following an underground nuclear test, an acoustic pulse propagates upward through the atmosphere and sets the ionosphere in motion which, in turn, generates gravity waves. The usual ionospheric monitoring approach is to use a phase sounder to observe the acoustic pulse. However, there are other detection techniques that can be employed. These detection techniques include the use of a low-frequency filter so that only long period (approximately 10 minutes) gravity waves can be observed. Another detection technique is to correlate microbarographic measurements on the surface with HF sounder data from the ionosphere to measure Lamb waves. A third detection technique is to correlate seismometer measurements in the ground with their corresponding ionospheric perturbations. The theoretical and experimental aspects of these remote detection techniques are discussed here.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 45166

45072 **(CONF-850612—8) Meso- and synoptic-scale pollutant transport. Review of episode formation and transport meteorology, methods of analysis, and anatomy.** Lazaro, M.A. (Chicago Univ., IL (USA). Dept. of Geophysical Sciences; Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017045.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

This paper reviews and summarizes the meso- and synoptic-scale pollutant phenomena and the types of meteorological conditions that are associated with the formation of persistent elevated pollution episodes. Various types of wet and dry mesosynoptics conducive to such episodes are identified and reviewed. The importance of gaining a better understanding of how various complex meso- and synoptic-scale systems act to vent pollutants through the top of the planetary boundary layer (PBL), redistribute pollutants within the PBL, and remove pollutants at the surface is underscored. The status of development, strengths, and weaknesses of four major source-receptor analysis approaches are discussed. These approaches include empirical tracer and remote-sensing techniques and semi-empirical or theoretical trajectory-analysis methods and meso- and synoptic-scale transmission models. Specific areas of development and improvement in each of the methods are identified. The integrated application of these techniques for the analysis of source-receptor relationships is highly desirable for formulation and evaluation of strategy options for the control and mitigation of acid deposition. Finally, eastern North American air-pollution episodes noted in the literature are highlighted, and the anatomy of two episodes is presented. 188 refs., 17 figs., 13 tabs.

45073 **(EPRI-EA—1074, pp 2.41-2.72) Diagnosis and prediction of tropospheric trajectories and cleansing.** Kreitzberg, C.W.; Leach, M.J. (Drexel Univ., Philadelphia, PA). 1979. NTIS, PC A12/MF A01. (CONF-780611—). Contract AC02-76EV02360.

From AIChE symposium; Philadelphia, PA, USA (4 Jun 1978).

Use of a numerical weather prediction model to predict trajectories over distances of approximately 1000 km and times of approximately 12 hours is demonstrated for a particular storm on April 3 and 4, 1974. Cleansing is defined as the amount of precipitation (in mm) falling through the air parcel while moving along the air parcel trajectory. The precipitation can be stratiform (steady rain) and/or convective (showery), and its variation in three space dimensions and time is predicted by the hydrodynamic model that predicts wind fields. The sensitivity of these weather predictions and trajectory and cleansing computations to model resolution (namely, 140-km, and 35-km horizontal grid size) is investigated. The trajectories are sensitive to grid resolution because both the horizontal winds and the vertical velocities differ with grid resolution. In frontal cyclones, horizontal winds change markedly with height so the trajectories, as well as precipitation and cleansing, are sensitive to the vertical velocities that can be resolved. The conclusion is that dynamic models can be expected to give more realistic trajectories than even an ideal analysis system limited to winds from rawinsonde observations and surface reports. Direct observations simply cannot resolve the spatial scales and the vertical motions necessary for really good trajectories in mid-latitude storm systems.

45074 **(EUR—9673-EN/I) Local scale atmospheric diffusion at a coastal site in the presence of breeze effect. (Phase III: Data elaboration and model development). Vol. 1.** Cagnetti, P.; Ferrara, V.; Pellegrini, A. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 83p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The aim of this contract is the characterization, from the thermal and anemological point of view, of the lower layers of the atmosphere at a coastal site, affected by breeze circulation. Data are utilized to set up diffusion models for accidental releases of airborne materials, both of short and prolonged duration. Five inland meteorological campaigns, starting from Jan. 83 (Jan., Apr., Jul., Oct. 1982, Jan. 1983), have been carried out; an appropriate extension of the contract allowed the execution of two more campaigns in the open sea (Apr., Jul. 1983), utilizing the oceanographic ship 'Bannock' kindly supplied by CNR. The analysis of the data showed the development of a well defined IBL during on-shore flow only in Spring and Summer, while an inversion layer was detectable aloft independently of the season (provided that an anticyclonic situation was present). According to those relevant features a simple diffusion model has been developed for short duration releases at local scale. Finally, the analysis and elaboration of the data, collected on site by a meteorological automatic station, allowed the extension of the model to prolonged releases.

45075 **(EUR—9678-EN) Finite-element formulation of a variational procedure of wind-field adjustment over complex terrain.** Caneill, J.Y.; Granier, J.P.; Racher, P.; Rosset, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 143p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A mass-consistent variational formulation was elaborated upon, for an objective analysis of local and regional scale wind fields. A numerical resolution is performed after a three dimensional discretization by finite elements. Sensitivity tests emphasized the importance of weighthing factors such as K which defines the relative contributions of the over/around wind components over complex terrain. The method is then tested for the island of Hawaii using climatological data and finally is tested in comparison with a mesoscale model. Moreover, intercomparison with WAFT model developed in the framework of the contrat SRO14 UK are undertaken, on various meteorological situations.

45076 **(PB—85-202208/XAB) Measurements of the plume path of a heavy plume.** Xiao-yun, L. (Technische Hogeschool Delft (Netherlands)). Jan 1985. 99p. NTIS, PC E05/MF E01.

An experimental study was carried out to test the theoretical model for a heavy stack plume developed by Ooms, Mahieu and Zelis. As a result of the measurements, the computer program belonging to this model was improved by the introduction of alternative initial conditions. A review of the model, the description of the initial conditions, the detailed information about the experiments, and a comparison between the experimental results and the predicted results are described in this report.

45077 **(UCRL—15705) Angular momentum balance simulated in January and July by the OSU two-level atmospheric general circulation model in a ten-year control simulation.** Stoker, T.D. (Oregon State Univ., Corvallis (USA). Climatic Research Inst.). Nov 1984. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017263.

Report No. 58.

A new angular momentum balance has been formulated and applied to the diagnosis of the vertically-integrated January and July angular momentum balances of a ten-year control run of the OSU two-level atmospheric general circulation model (AGCM). The technical improvements over the earlier formulation by Kim and Grady (1980, 1982) are enumerated, with the greatest differences between the results of the two formulations appearing in the global distributions of the horizontal flux convergence of relative angular momentum by the transient component of the circulation and in the distribution of the July pressure-gradient torque. Comparisons are drawn between the simulated angular momentum balance and the balance inferred from observations by Oort and Peixoto (1983). Several features of the globally- and hemispherically-averaged angular momentum balance are discussed. The pressure-gradient and surface frictional torques provide the chief sink and source, respectively, of angular momentum. Both torques are

shown to be 2 to 3 times greater in the Northern Hemisphere than during the corresponding season in the Southern Hemisphere, and in both January and July they balance in such a way as to require a net horizontal convergence of both relative and absolute angular momentum into the winter hemisphere. The northen hemisphere relative angular momentum density is shown to be five times greater in January than in July, while the averaged angular momentum fluxes during the northern hemisphere summer are very small. The net poleward flux of relative angular momentum in the Southern Hemisphere is accomplished primarily by the transient component of the circulation; both the standing and transient components transport momentum in the same direction, while in the Northern Hemisphere it is accomplished primarily by the standing component with the standing and transient components transporting momentum in opposite directions. 13 refs., 15 figs.

45078 **(UCRL—92933) Statistical comparison of two major gridded temperature records of the northern hemisphere.** Grotch, S.L. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 5p. (CONF-851028—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016076.

From 9. conference on probability and statistics in atmospheric sciences; Virginia Beach, VA, USA (9 Oct 1985).

The global surface temperature records of the Climate Research Unit (CRU) of the university of East Anglia and that of the Russians were compared to examined their accuracy and any possible discrepancies. The CRU and the Russian gridded temperature curves are in excellent agreement when average northern hemisphere behavior is compared. There are, however, several grid points where differences between the two data sets warrant further study. 4 refs., 10 figs. (ACR)

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 43643, 43655, 43656, 43659, 43660, 43664, 43665, 43670, 43672, 43676, 43851, 44175, 44566, 44570, 44697, 45072, 45074, 45136, 45139, 45167, 45269

45079 **(BNL—51881) Oxidizing and Scavenging Characteristics of April Rains - OSCAR data report.** Benkovitz, C.M.; Evans, V.A.; Tichler, J.L.; Hayes, J.V.; Norden, K.J. (Brookhaven National Lab., Upton, NY (USA)). Oct 1984. Contract AC02-76CH00016. 245p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85017014.

The organization of this report is as follows: Chapter 1 presents a description of the OSCAR experiment, including its objectives, design, and field deployment. Chapter 2 presents the OSCAR Central Data Coordination function and summarizes the tasks needed to compile each data set. Chapters 3 through 6 address each of the four OSCAR events. A synoptic description of each event is presented in these chapters, followed by a summary of the data captured during the event. Chapter 3 and Appendices C-G then present detailed tabular and graphical displays of the data captured during this event by the intermediate-density precipitation chemistry network, the BNL aircraft and the surface air chemistry measurements conducted by BNL and by state/province agency networks. Data from the high-density precipitation chemistry network are being presented in a separate series of reports by Pacific Northwest Laboratory. Detailed displays of the data for events 2 to 4 have not been included in this report; however, selected portions could be developed for interested parties.

45080 **(CONF-790887—2) MIT two-wavelength laser system for measuring atmospheric methane.** Dewey, C.F. Jr. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). 1979. Contract AC02-77EV04447. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013214.

From Gas Research Institute symposium on methane detection and measurements; Chicago, IL, USA (27 Aug 1979).

The key fact that makes the two-wavelength He-Ne laser operating near 3.39 μm so attractive for methane measurement is that one of the two lines is strongly absorbed by methane whereas the other is only weakly absorbed. Yet despite the large difference in absorption, the two lines differ in wavelength by only 3 parts in 10,000. Dirt, aerosols, and surface films on optics do not have the sharp line structure of methane; and therefore attenuation by these contaminants occurs equally for the two beams. This is a most useful property, because accurate measurements of methane concentration may be made by considering only intensity ratios rather than the absolute value of a transmitted beam as it is effected by spurious scattering. In this presentation, the following four general topics are discussed: description of the two-wavelength instrument; operating modes of a two-wavelength laser; some details of the methane absorption of 3.39 μm laser radiation; and possible applications and extensions of the instrument concept. 8 refs., 10 figs.

45081 **(CONF-850612—7) Estimating the air quality impacts of flare operations.** Hunsaker, D.B. Jr.; Kornegay, F.C. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016418.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

The body of information presented in this paper is directed to air quality planners and engineers who are interested in predicting the air quality impacts of proposed facilities using flares for pollution control devices. Available plume rise algorithms are used to compare predicted plume rise values for typical large and small commercial flares for a range of momentum effects and atmospheric stability conditions. It is found that buoyant flare plumes have the greatest potential for impact under unstable atmospheric conditions, in which the vertical motion of the atmosphere brings the flare emissions to ground level before appreciable dispersion has occurred. Plume rise and associated ground-level concentrations from momentum-dominated flare plumes were found to be unaffected by stability conditions; the predicted pollutant concentrations (10^{-5} g/m^3), and distances of the concentration from release point (less than 0.5 km), agreed with those for buoyant plumes under unstable conditions. In these cases, flare emissions could produce high ground level pollutant concentrations, depending on the emission rate. It is recommended that a flare plume rise field research program be initiated to better quantify flare plume rise and associated ground-level pollutant concentrations under various atmospheric conditions.

45082 **(CONF-850943—5) Mercury in rain and throughfall in a tropical rain forest.** Lindberg, S.E.; Harriss, R.C. (Oak Ridge National Lab., TN (USA); National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017099.

From 5. international conference on heavy metals in the environment; Athens, Greece (10 Sep 1985).

The major hydrologic pathways from the atmosphere to the ground in a tropical rain forest were sampled to determine the wet deposition of mercury above and below the canopy. The concentrations of mercury in rain averaged 74 ng L^{-1} and were inversely proportional to rainfall amount. Concentrations in stemflow and throughfall were comparable, averaging ~66 ng L^{-1}. As a result of these lower concentrations and significant rainfall interception and evaporation in the canopy, the total wet fluxes below the canopy were lower than those above, suggesting in-canopy sorption of dissolved mercury. 7 refs., 1 fig., 2 tabs.

45083 (DOE/EV—0040, pp 149-154) **Field experiments and observations.** Jul 1979. NTIS (US Sales Only), PC A18/MF A01.

In Multistate atmospheric power production pollution study-MAP3S. Progress report for FY 1977 and FY 1978.

An intensive study of the growth of the convective mixing layer was conducted by ANL during the summer of 1975. This was the first of the Sangamon experiments, led directly to the first truly cooperative MAP3S field experiment, a study of pollutant behavior associated with the development of the nocturnal inversion conducted by ANL, PNL and ISWS during the summer of 1976.

45084 (DOE/EV—0040, pp 230-232) **Gas-phase oxidation of SO_2.** Jul 1979. NTIS (US Sales Only), PC A18/MF A01.

In Multistate atmospheric power production pollution study-MAP3S. Progress report for FY 1977 and FY 1978.

During the past few years it has become apparent that the gas-phase reaction kinetics for the oxidation of tropospheric SO_2 are determined largely by the photochemistry of the so-called smog reactions involving nitrogen oxides, ozone, hydrocarbons and many related compounds and free-radicals. For the purpose of modeling these chemical transformations in the ambient atmosphere, one aim of the MAP3S program is to develop a region-wide atmospheric model that can incorporate transport and non-linear chemical reactions. For such application it is desirable that the chemical model be constructed with a minimum number of constituents, because the computational time and cost involved in simulating atmospheric transport with chemical transformations increase dramatically with the number of species modeled. Methods used to construct this model are presented.

45085 (DOE/EV--0040, pp 236-239) **Heterogeneous oxidation of SO_2.** Jul 1979. NTIS (US Sales Only), PC A18/MF A01.

In Multistate atmospheric power production pollution study-MAP3S. Progress report for FY 1977 and FY 1978.

As a component of the MAP3S chemical modeling activity, the aqueous phase oxidation of SO_2 to sulfate in cloud or fog water has been examined. The rate of such reactions may be governed either by the kinetics of mass transfer processes, or by reaction kinetics, depending upon the relative magnitudes of the time constants for the two processes.

45086 (DOE/EV—0040, pp 340-346) **Field experiments.** Jul 1979. NTIS (US Sales Only), PC A18/MF A01.

In Multistate atmospheric power production pollution study-MAP3S. Progress report for FY 1977 and FY 1978.

The prime purpose of these studies is to address the problem of regional-scale sulfur pollution. Emphasis is focused on transport, transformation, and removal processes. They are intended to document the long-term characteristics of atmospheric pollutants over the MAP3S region, including such features as the spatial and temporal variability.

45087 **(DOE/OR/00033—T154) Uncertainty in carbon emissions, 1975-2075.** Edmonds, J.; Reilly, J.; Gardner, R.; Brenkert, A. (Oak Ridge Associated Universities, Inc., TN (USA); Oak Ridge National Lab., TN (USA)). 31 Jul 1985. Contract AC05-76OR00033. 332p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85016825.

This report documents the results of work with the IEA/ORAU Long-Term Global Energy-CO_2 model to analyze model predictions of future global carbon emissions from fossil fuel use and the uncertainty surrounding such forecasts. The methodology utilized state-of-the-art techniques of uncertainty analysis along with review and revision of the IEA/ORAU model structure, and review and description of uncertainty surrounding model assumptions and parameters to explore uncertainty in fossil fuel CO_2 emissions over the period 1975 to 2075. Possible interrelationships among assumptions and parameters, and their effects on overall forecast uncertainty are explored. The major findings include: (1) the median rate of CO_2 emissions grows at an average annual rate of 1.0% per year; (2) overall uncertainty in the emission rate was found to be considerable. A range of 3.0% per year growth in emissions and a decline of 1.4% per year are needed to bracket 90% of the 400 randomly generated scenarios; and (3) low and declining CO_2 emissions rates appear more likely than past research has indicated. Roughly one quarter of the scenarios show global emissions falling from current levels. 49 refs., 12 figs., 14 tabs.

45088 **(DOE/OR/21363—3) Preliminary estimates of airborne pollutant fluxes to the Camp Branch and Cross Creek watersheds.** Hosker, R.P. Jr.; Rao, K.S.; Hicks, B.B. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). Oct 1984. Contract AI05-83OR21363. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016914.

This report describes a brief, preliminary attempt to (1) model SO_2 concentrations and fluxes to deciduous forest canopies at two research sites operated by the Tennessee Valley Authority, (2) to assess the utility of the present measurement program and data set for modeling purposes, and (3) to recommend improvements necessary to facilitate further analyses. The Camp Branch and Cross Creek watershed sites characteristics and meteorology are described. The wind roses for these sites are presented and discussed in some detail, to facilitate future analysis and experimental planning. A sector-box model with time-dependent mixed-layer depth, first-order chemical conversion of SO_2 to SO_4/sup =/, and wet and dry en route removal of both chemical species was used to approximate long-range transport from two large coal-fired power plants. SO_2 concentrations at Cross Creek due to a source <25 km distant were predicted with some success; individual predictions were accurate within a factor of ten, but with a great deal of scatter. For all other source-receptor combinations, individual concentrations were rather poorly predicted. A one-dimensional flux model based on canopy radiation balance and measured vertical gradients (differences) of SO_2 concentration, temperature, and moisture is presented. Recommendations are given.

45089 **(DOE/OR/21400—T161) Acid deposition and the acidification of soils and waters.** Reuss, J.O.; Johnson, D.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 256p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85016544.

A conceptual model of acid deposition is presented consistent with established physicochemical principles and the bulk of available information. The authors seek to provide insight into probable long-term effects of acid deposition; a testable hypotheses; plus design and interpretation of the research. (PSB)

45090 **(EPRI-EA—3757) Application of ALPHA-1 to plume model validation and development at a moderately complex site. Final report.** Uthe, E.E.; Morley, B.M. (SRI International, Menlo Park, CA (USA)). Aug 1985. 61p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920848.

This report discusses the ALPHA-1 hardware, experimental procedures used during the two field programs conducted at the moderately complex terrain site, and data-analysis procedures for computing plume transport and diffusion parameters. Facsimile data examples illustrate the variety of plume and boundary layer distributions that occurred during the Bull Run data-collection program. Listings of hour-averaged Gaussian plume parameters derived from the data records are presented for use in plume model validation and development. The lidar pictures indicate that terrain effects mostly occur during early convective periods, with highest convective cells located over highest terrain features. The convective cells cause erosion of elevated stable plumes and mixing of plume particulates to the surface level. 20 figs., 3 tabs.

45091 **(EPRI-EA—4165) Groundwater data analyses at utility waste disposal sites. Final report.** Summers, K.V.; Rupp, G.L.; Davis, G.F.; Gherini, S.A. (Tetra Tech, Inc., Lafayette, CA (USA)). Jul 1985. 411p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920797.

A detailed technical analysis was made of waste and ground water data from six utility solid waste disposal sites. The six sites investigated were Allen (Duke Power Co.), Elrama (Duquesne Light Co.), Dave Johnston (Pacific Power and Light Co.), Powerton (Commonwealth Edison Co.), Sherco (Northern State Power Co.) and Lansing Smith (Gulf Power Co.). The sites included unlined ash ponds, a lined ash/FGD sludge pond, ash landfills, and an ash/FGD sludge landfill. The data were analyzed to determine if solute release from the wastes, solute migration by advection and dispersion, and chemical attenuation could be inferred from the waste and ground water solute concentrations. Waste interstitial solution concentrations showed elevated levels, relative to background, for the major ions (Ca, Mg, K, Na, SO_4 and Cl) and some trace elements (e.g., B. Sr, As, Se, Cu, Co, V). Some of the solutes measured in the waste (e.g., Cu, Co, V) were seldom above detection in downgradient waters, suggesting that chemical attenuation may have occurred either in the waste itself or in the downgradient formations. Other trace elements (e.g., Ag, Be, Ti, and Zr) were seldom detected in any of the samples including waste interstitial

waters, possibly due to limited leaching from the waste or to low concentrations in the waste. Further data are needed. 16 refs., 99 figs., 52 tabs.

45092 (EPRI-EA—4190) Review of field-scale physical solute transport processes in saturated and unsaturated porous media. Final report. Waldrop, W.R. (Tennessee Valley Authority, Norris (USA)). Aug 1985. 112p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920796.

The development of accurate mathematical models to predict field-scale solute transport in the saturated and unsaturated zones is hampered by the lack of reliable data on field-scale transport parameters. A critical review of the available literature on studies conducted at 55 saturated zone and 28 unsaturated zone sites produced 99 and 8 longitudinal dispersivity values, respectively. In the saturated zone, the scale of observation for all the data ranged from 0.75 m to 100 km with longitudinal dispersivities from 0.01 to 5500 m. However, only five sites produced highly reliable dispersivity data, based on an evaluation of the test configuration, the tracer monitoring, and the data analysis method for each site. The largest scale of high reliability dispersivities was only 115 m. The high reliability data subset indicates that the dispersivity initially increases with the scale of observation. But it is not clear whether the dispersivity increases indefinitely with scale or reaches an asymptotic value as is assumed in classical modelling and predicted by recent stochastic theories. In the unsaturated zone the dispersivity ranged from 1 mm to 0.7 m and appeared to increase with the scale of observation from 1 m to 20 m; however, most experiments were at scales of about 2 m. The transport process is dominated by the lateral movement of solutes in dry, high tension soils whereas in nearly saturated soils the solutes and water can move rapidly downward through the macrostructures. There is a clear need to conduct controlled large-scale field experiments in both the saturated and unsaturated zones to obtain reliable dispersivities at increasing scales and to identify the controlling transport mechanisms.

45093 (EUR—8925) Exchange of information concerning atmospheric pollution by certain sulfur compounds and suspended particulates in the European Community. Annual report for January to December 1978. de Bruyn, W.A. (Commission of the European Communities, Luxembourg). 1985. 148p. Commission of the European Communities, Luxembourg.

This report presents the third analysis of yearly air pollution data for specific pollutants in the countries of the European Community. The first seven chapters have been revised with the latest information available and have been clarified where necessary. They contain all the background inform.tion about the stations, the data, the techniques of measurement, the organisation of the data collection per country and any other subject which requires precise definition or explanation in order to understand the data. In this first part it has been stressed that data cannot be compared, except where measurement techniques are identical, usually within a town. Chapter VIII presents the results of the analysis of the pollution data for 1978. Comparing data only at the town level, the two characteristics of the data for 1976 and 1977 become again apparent: -the levels of pollution are generally higher in the winter than in the summer; -the three maximum values of the pollution levels were often registered at the same station in a town. In the summary report of the three years of air pollution data a more detailed analysis will be presented particularly of those charactersitics of air pollution level which are linked to inherent characteristics of the ambient pollution.

45094 (GSF-OE—820) Ecological chemistry - state-of-the-art. Korte, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Dec 1984. 62p. (In German and English). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752672.

The report describes the current situation of ecological chemistry, its tasks and main focuses of research. The different conceptional approaches, no matter whether they are substance, effect, medium or branch-related, are discussed. The ecodiagnostics of environmental chemicals are demonstrated by means of numerous examples. The different possibilities for ecoprophylaxis and ecotherapy are dealt with.

45095 (IVL-B—516) Fate of sulfuric acid aerosol in the atmosphere. Brosset, C. (Swedish Water and Air Pollution Research Lab., Goeteborg). 1979. 17p. (CONF-791090—). Swedish Water and Air Pollution Research Lab., Goeteborg.

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

The phase diagram for $(NH_4)_2SO_4$-H_2SO_4-H_2O was complemented with tielines for the ammonia equilibrium concentration over the liquid phase. Such a complete diagram provides information essentially on the phase composition attained by a sulfuric acid droplet in equilibrium with the atmosphere. This composition can also be calculated if the relative humidity (RH) and the concentration of ammonia (pNH_3) of the atmosphere are known. Whether such calculations reflect real conditions or not depends on the equilibrium adjustment, i.e., if it is sufficiently fast relative to the variation in temperature (t), RH, and pNH_3 of the atmosphere. It was shown that the graphic correlation between RH and log pNH_3 provides direct information on the phases present and their possible transformations. Such information, obtained through measurements of RH and pNH_3, was in good agreement with particle composition established through chemical analysis.

45096 (IVL-B—545) Equilibrium composition of aerosols generated from sulfuric and nitric acids, water, and ammonia. Brosset, C. (Swedish Water and Air Pollution Research Lab., Goeteborg). Mar 1980. 15p. (CONF-791090—). Swedish Water and Air Pollution Research Lab., Goeteborg.

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

The water-soluble part of airborne fine white (graphite poor) particles is usually with reference to its ionic composition in equilibrium with air. This has been checked by means of the phase diagram for the system $(NH_4)SO_4$-H_2SO_4-H_2O which is now available. In the same way it has been shown that the ionic concentration in precipitation probably represents equilibrium condition near the cloud base and not at the ground level. Finally the disagreement between the composition of the water-soluble part of black (graphite rich) particles and the air according to the phase diagram may be due to an analytical bias caused by a sorbed alkaline layer on the graphite particles.

45097 (Juel—1949) Deposition and retention of air pollutants on vegetation and other atmospheric interfaces. Jonas, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz; Technische Hochschule Aachen (Germany, F.R.)). Sep 1984. 400p. (In German). NTIS (US Sales Only), PC A17/MF A01. File Number DE85751871.

The question of the deposition of aerosols and gases are applied to biological and ecological problems concerning the filtering aspect of atmospheric interfaces, especially vegetation, with respect to air pollution, and also the resulting pollutant effect. In order to determine the deposition of aerosols, numerous field experiments were carried out. The deposition of gases was treated on the basis of current literature data. The experiments indicate that the deposition of aerosols on grass largely depends on aerosol diameter, dry weight per unit area and the wind velocity or turbulence of the air layer near the ground. Of the interfaces studied, namely soil without vegetation, water, filter paper, smooth and structured metals, grass, clover and trees, the latter had the greatest dust collecting capability. It is recommended that in the afforestation of areas in the close proximity of industrial regions the common beech, silver birch and Japanese larch should be taken into particular consideration due to their great deposition effectiveness with respect to dusts and their comparatively high resistance to pollutant gases. Silver birch and moreover red horse chestnut should be considered for filtering the air in urban regions because of the high aerosol deposition.

45098 **(LBL—17072-Exc.) Building ventilation and indoor air quality. Annual report, FY 1983. Excerpt.** (Lawrence Berkeley Lab., CA (USA)). Jul 1984. Contract AC03-76SF00098. 27p. (EEB-Vent—84-1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016558.

Research includes characterization of the emission of various pollutant classes from their respective sources, study of the effectiveness of ventilation in removing pollutants from indoor atmosphere, and examination of the nature and importance of chemical and physical reactions that can affect the occurrence and amount of airborne pollutants. The program has groups devoted specifically to three major pollutant classes: combustion products, arising from indoor appliances and other sources; radon and its daughters, arising from materials that contain radium, a naturally occurring radionuclide; and formaldehyde and other organics, arising from a variety of materials and furnishings. In addition, other groups study techniques for controlling airborne concentrations, develop devices for monitoring pollutants in laboratories and buildings, and design or carry out field surveys of indoor air quality. Significant effort is also devoted to assessment of the health effects of indoor pollutants exposures. The core of these efforts consists of research on the behavior of indoor air pollutants, specifically the influence on airborne concentrations of three classes of factors: source strengths or emission rates, ventilation rates or effectiveness, and reaction and transformation mechanisms. The work carried out by the individual groups is primarily experimental, consisting of fundamental - and often quite sophisticated - experiments on pollutant emission, transport, and removal, complemented by significant efforts advancing the theoretical framework within which results maybe considered.

45099 **(PB—85-198257/XAB) Measurement of stack-gas concentrations in the infrared region of the spectrum.** Janatuinen, T.; Byckling, E. (Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics). 1985. 29p. (TKK-F-A—574). NTIS, PC E04/MF E01.

Optical methods can be used for continuous across-the-stack measurement of stack gas concentrations. The infrared region of the spectrum is best suited for the measurement. Stack gases of power plants using coal, oil, gas and peat consist primarily of water vapor, carbon dioxide and nitrogen. There are also small amounts of carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons etc. Continuous concentration measurement seems to be possible for most gas components in the wavelength region 3-6 micrometers. The main problems in the measurement are due to strong carbon dioxide and water vapor absorption.

45100 **(PB—85-199073/XAB) Industrial boiler SO_2 cost report.** Laughlin, J.H.; Maddox, J.A.; Margerum, S.C. (Radian Corp., Research Triangle Park, NC (USA)). Nov 1984. 88p. NTIS, PC A05/MF A01.

This report is a resource document for the development of Federal standards of performance for control of sulfur dioxide emissions for new industrial boilers. It presents capital and annualized costs for SO_2 control technologies applied to coal- and residual oil-fired industrial boilers. Control costs are presented for model boilers with heat-input capacities of 100, 150, 250, and 400 million Btu per hour firing fuels with various sulfur contents and achieving 50, 70, and 90% SO_2 reduction using flue-gas-desulfurization systems. The algorithms used to calculate these costs are also presented.

45101 **(PB—85-200020/XAB) Temporal and spatial variability of the visual effects of stack plumes. Final report, 1 February 1983-1 January 1984.** Seigneur, C.; Hudischewskyj, A.B.; Hogo, H. (Systems Applications, Inc., San Rafael, CA (USA)). May 1985. 49p. NTIS, PC A03/MF A01.

Temporal and spatial variabilities of stack plumes are analyzed by means of field data analysis and computer simulations. In this investigation, photographs from field programs of the study Visibility Impairment due to Sulfur Transport and Transformation in the Atmosphere were analyzed via sensitometry, and PLUVUE II model simulations were conducted for a case study. Analysis of the temporal variability of plume visibility led to documentation of the fact that the visual effects of plumes vary with time because of (1) turbulent fluctuations, (2) changes in atmospheric stability, and (3) changes in the observer-plume-sun scattering angle. Likewise, the analysis of the spatial variability of plume visibility led to the fact that the visual effects of plumes vary with downwind distance from the stacks because of (1) turbulent fluctuations, (2) dilution of the plume and/or a change in the observer-plume distance, and (3) changes in the observer-plume-sun scattering angle.

45102 **(PB—85-201150/XAB) Assessment of the long-term precision of continuous-emission monitors.** Rollins, R.; Logan, T.J.; Midgett, M.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). 1985. 16p. (EPA—600/D-85/111). NTIS, PC A02/MF A01.

The EPA has promulgated regulations requiring certain stationary sources to show continual compliance with emission limits, by using a Continuous Emission Monitoring System (CEMS). In order to make reliable compliance determinations, the quality of the monitoring data is important. Two principal parameters in assessing and describing data quality are precision and accuracy. The paper discusses the long-term precision for five CEMS's installed at scrubber-controlled, coal-fired power plants. Precision estimates were made by utilizing available daily calibration drift data. Six to seven months of calibration drift data were analyzed for each pollutant (SO_2, NOx) and diluent (O_2, CO_2) analyzer in the CEMS. Results show that most of the monitors exhibited significant bias and variance over the months involved. Monitoring data precision varied significantly from month to month and does not appear to be related to monitor type or manufacturer.

45103 **(PB—85-205144/XAB) Second review of standards of performance for sewage sludge incinerators.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1984. 139p. (EPA—450/3-84/010). NTIS, PC A07/MF A01.

Standards to control emissions from new and existing sewage-sludge incinerators are reviewed. Information on the background and authority regulatory alternatives considered and the economic impacts of the proposed regulations is presented.

45104 **(PB—85-207611/XAB) Emission inventory for urban particle-model validation in the Philadelphia AQCR (air quality control region). Final report, June 1982-September 1984.** Toothman, D.A.; Thames, J.C.; Yates, J.C.; Segall, R.R.; Bolstad, J.N. (Engineering-Science, Inc., Fairfax, VA (USA)). May 1985. 624p. NTIS, PC A99/MF A01.

The U.S. Environmental Protection Agency (EPA) is in the process of revising the National Ambient Air Quality Standards for total suspended particulates (TSP) to account for the fact that smaller particles are responsible for adverse health effects. The new standard has not been finalized but is expected to be for PM10 particulate matter with aerodynamic diameters of 10 microns or below. The states will be required to revise their State Implementation Plans (SIPs) for attainment or maintenance of the standard. For the States use, EPA is developing and will validate an Urban Particle Model. Philadelphia was chosen as the site for a validation study because it has a good mix of industrial emissions and is the site of an EPA validation program for the Urban Airshed photochemical oxidant model. Ambient data were collected from 6p.m. July 14 to 6p.m. August 13, 1982, at six sites in the Philadelphia area. To assist in the validation program, an emissions input for the urban particle model was obtained. Hourly emissions estimates during the monitoring period for the pollutants: fine particles, coarse particles, fine primary sulfate, coarse primary sulfate, and sulfur dioxide are included. All point sources other than 300 major point sources were combined into the 289, 2.5-by 2.5 kilometer grid cells used for area sources and highway vehicles.

45105 **(PB—85-215713/XAB) Model for evaluation of refinery and synfuels VOC (volatile organic compounds) emission data. Volume 1. Technical report and Appendix A. Final report, June 1983-September 1984.** Wetherold, R.G.; Harris, G.E.; Skinner, F.D.; Provost, L.P. (Radian Corp., Austin, TX (USA)). May 1985. 269p. (RAD—84-234-004-15). NTIS, PC A12/MF A01.

The report describes the development of a model for estimating emissions of volatile organic compounds (VOCs) from pe-

troleum refineries and synfuel plants. The model, responding to a need to define a consistent and comprehensive approach for estimating VOC emissions from these two sources, is a modular technique in which the entire spectrum of potential VOC emissions sources was defined in a number of process and utility modules. Each module represents a process or auxiliary unit. The user of the model provides emission source counts and other process information, or uses provided default values. Emissions are calculated using emission factors for each source type. Detailed examples of the application of the model to both refineries and synfuel plants are presented. Such estimates, of considerable interest to the EPA, industry, and the public, are needed in the preparation and review of Environmental Impact Statements (EIS) and permits required by the Clean Air Act. Responding to this need, several studies have been made of VOC emissions, particularly from refineries. Methods for estimating VOC emissions and the results of VOC emissions tests have been published in various journals and at various forums.

45106 **(PB—85-215721/XAB) Model for evaluation of refinery and synfuels VOC (volatile organic compounds) emission data. Volume 2. Appendices B and C. Final report, June 1983-September 1984.** Wetherold, R.G.; Harris, G.E.; Skinner, F.D.; Provost, L.P. (Radian Corp., Austin, TX (USA)). May 1985. 170p. (RAD—84-234-004-15). NTIS, PC A08/MF A01.

The report describes the development of a model for estimating emissions of volatile organic compounds (VOCs) from petroleum refineries and synfuel plants. The model, responding to a need to define a consistent and comprehensive approach for estimating VOC emissions from these two sources, is a modular technique in which the entire spectrum of potential VOC emissions sources was defined in a number of process and utility modules. Each module represents a process or auxiliary unit. The user of the model provides emission source counts and other process information, or uses provided default values. Emissions are calculated using emission factors for each source type. Detailed examples of the application of the model to both refineries and synfuel plants are presented. Such estimates, of considerable interest to the EPA, industry, and the public, are needed in the preparation and review of Environmental Impact Statements (EIS) and permits required by the Clean Air Act. Responding to this need, several studies have been made of VOC emissions, particularly from refineries. Methods for estimating VOC emissions and the results of VOC emissions tests have been published in various journals and at various forums.

45107 **(PB—85-219418/XAB) Safety in the use of asbestos: an ILO (International Labour Office) code of practice.** (International Labour Organization, Geneva (Switzerland)). 1984. 129p. NTIS, PC $10.00/MF $10.00.

In recent years there has been a growing awareness that exposure to asbestos dust can have harmful effects on the health of workers. Among the subjects on which general guidance is given in the first part of the code are monitoring at the workplace, preventive measures, the protection and supervision of the health of workers, and the packaging, handling, transport and disposal of asbestos waste. More detailed guidance on the limitation of exposure to asbestos in specific activities is given in the second part of the code, which includes sections on mining and milling, asbestos cement, textiles, friction materials and the removal of asbestos-containing materials.

45108 (PB—287436, pp 3-25) **Evaluation of a Modified Method 6 flue gas sampling procedure.** Dietz, R.N.; Wieser, R.F.; Newman, L. (Brookhaven National Lab., Upton, NY). Aug 1978. NTIS, PC A13/MF A01. (EPA—600/9-78-020a).

In Workshop proceedings on primary sulfate emissions from combustion sources. Volume 1. Measurement technology.

The character of primary sulfate emissions (i.e., H_2SO_4 and water-soluble sulfate salts) must be determined using flue gas sampling methods that differentiate between the acid form and the less nocuous sulfates. These methods must be used in considering potential health effects and in determining the mechanisms and parameters that affect the magnitude and distribution of such emissions. As recommended, the modified EPA Method 6 does not provide for specific determination of sulfate particulates and H_2SO_4. A Brookhaven modification, based on an isokinetically-sized nozzle and quartz fiber filter assembly, has been shown to collect quantitatively, in situ, all the particulate sulfate. Sulfuric acid was passed through the filter for subsequent quantitative collection, and no spurious formation of acid by oxidation of SO_2 was found on the filter. Problems associated with sub-isokinetic particulate sampling, leading to significant positive sulfate measurement errors, will be discussed. In many cases, the isopropyl alcohol (IPA) used to collect the H_2SO_4 vapor contained sufficient oxidant to produce positive errors 10-fold or more when actual flue gas acid levels were less than 1 ppM. In addition, stripping experiments demonstrated the presence of dissolved SO_2 equivalent to 1 ppM to 3 ppM of flue gas acid even after 16- to 32-minute purging periods. The significance of these errors and simple corrective procedures will be presented.

45109 (PB—287436, pp 145-159) **Collection methods for the determination of stationary source particulate sulfur and other elements.** Knapp, K.T.; Bennett, R.L.; Griffin, R.J.; Steward, R.C. 1978. NTIS, PC A13/MF A01. (EPA—600-9-78-020A).

In Workshop proceedings on primary sulfate emissions from combustion sources. Volume 1. Measurement technology.

The growing concern over the chemical composition of the particulate emissions from stationary sources has led to the improvement of sampling methods, so that representative samples compatible with chemical analysis can be obtained. Improvements include the development of techniques for obtaining particle-sized samples. Analytical techniques used should be sensitive; require minimal sample preparation and small samples, and work quickly. One technique that offers these qualities is x-ray fluorescence spectrometry (XRF). Some XRF systems can determine 30 elements in less than 10 minutes. In addition, these systems are non-destructive and require little preparation for filter samples. For light elements such as sulfur, the best results are obtained using samples collected uniformly on the surface of thin substances with a low mass, such as filters made of organic polymers. The colletion of samples on thin membranes at many sources has been the source of several major problems. The most severe problems are related to the temperature limitation of the filters and their degradation by hot sulfuric acid emissions. However, good samples for chemical analysis can be obtained in the field using temperature controls and careful handling. Since, in general, only small amounts of material are collected, the samples must be handled carefully in the laboratory to avoid sample loss, contamination, and moisture effects. The use of impactor-sized samples for XRF analysis creates additional problems, including non-uniform collection, many small piles of material, and substrates that usually are not compatible with the XRF spectrometer. Several techniques are presently being used to transfer these types of samples to compatible substances.

45110 **(PB—81126443) Critique of methods to measure dry deposition workshop summary.** Hicks, B.B.; Wesely, M.L.; Durham, J.L. (Argonne National Lab., IL (USA); Environmental Protection Agency, Research Triangle Park, NC (USA)). Oct 1980. 70p. (EPA—600/9-80-050). NTIS.

At the workshop on dry deposition methodology, held December 4 and 5, 1979, at the Argonne National Laboratory in Argonne, Illinois, dry deposition measurement techniques were assessed for routine monitoring use. A majority opinion was reached that commonly-used techniques such as surrogate surfaces and collection vessels are not sufficiently accurate for use in networks, because the highly varied properties of the natural surfaces of interest cannot be simulated adequately. Further research was recommended on dry deposition parameters in order to estimate dry deposition rates, if possible, from measurements of atmospheric concentrations at a single height, together with observations of surface properties and micrometeorological parameters. The ability to perform such investigations in the field is critically dependent upon advances in chemical and physical capabilities to provide methods with standard relative errors of less than 1 percent for a single instrument on successive measurements, or with time responses of less than 1 second. These requirements are not being achieved for many pollutant species. At present, the most promising methods for monitoring are eddy accumulation, modified Bowen ration, and variance. Alternative views are presented in Appendix C.

45111 (PB—82119447, pp 13-17) **Executive summary. Part I. Trace metals: executive summary.** Jan 1981. NTIS, PC A11/MF A01. (EPA—560/5-80-001).

In Potential atmospheric impact of chemicals released to the envnrionment. Proceedings of four workshops.

Information on numerous trace metals in atmospheric deposition potentially toxic to humans and other organisms was assimilated to determine if metal concentrations are increasing in atmospheric deposition and if these concentrations threaten human or organism health. On the basis of rates of emission, atmospheric concentrations, and known temporal trends in deposition, the greatest increases in concentrations of metals in atmospheric deposition due to human activity are expected for Ag, Cd, Cu, Pb, Sb, Se, Zn, with smaller increases expected for Cr and V and with little or no increases expected for Co, Mn, and Ni. There were insufficient data to rank Mo, As, Be, Sn, Te, and Tl. Numerous reports and literature were reviewed to assemble values for concentrations of trace organics in the atmosphere and in precipitation. They include PCBs, chlorinated hydrocarbon pesticides, and polycyclic aromatic hydrocarbons. Areas of future research needs are outlined.

45112 **(R—019-EPA-79) Characteristics and origins of sulfur dioxide, total suspended particulates, and sulfates in Western Pennsylvania.** Mahan, A.L.; Niemann, B.L.; Phillips, B. (Teknekron Research, Inc., Waltham, MA (USA)). Jun 1979. 153p. NTIS.

Studies show Pennsylvania has no Air Quality Control Region in compliance for total suspended particulates, nor for sulfur dioxide. This report addresses the occurrence and impact of long range transport of pollution into the state. Major conclusions based on a 3-state area of Pennsylvania, Ohio, and West Virginia show that interstate meteorological patterns of particulate and sulfur dioxide transport contributes massively to Pennsylvania's air pollution. The bulk of sulfate concentrations over the Upper Ohio River area originate from sulfur dioxide emissions from sources in the Lower Ohio River area.

45113 **Acid Precipitation: a current awareness bulletin.** Lanier, S.F.; Blackburn, P.S. (eds.). *Acid Precipitation;* No. 85/1, vp(15 Jan 1985). (PB—85-901001; DOE/APC—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

Research is reported on all aspects of the acid precipitation phenomenon. This includes sources (natural and man-made), atmospheric processes, monitoring, and environmental impacts. The research is intended primarily to identify and resolve uncertainties with data and models used for decisionmaking on policies and control strategies. The citations in this bulletin and other citations on acid precipitation back to 1974 are available on the Energy Data Base (EDB); searching and retrieval from EDB may be accomplished using either the DOE/Recon system on the Dialog or Mead Data Central commercial on-line retrieval systems. Retrospective searches can be made on any aspect of acid precipitation, or customized profiles can be developed to provide current information for each user's needs.

45114 **Comparison of methods of computing precipitation pH averages.** Stensland, G.J.; Bowersox, V.C. (Illinois State Water Survey, Champaign). *Journal of the Air Pollution Control Association;* No. 84-19.1, 1-16(1984). (CONF-840612—). Contract AC02-76EV01199.

From Air Pollution Control Association annual meeting; San Francisco, CA, USA (25 Jun 1984).

Precipitation chemistry data for sites in the National Atmospheric Deposition Program (NADP) network were used to compare four methods of computing pH averages. From 15 to 140 weekly precipitation pH values were available for the 53 sites examined in this study. The following four pH averages were examined: mean, median, sample volume weighted average pH, and the average pH calculated from the weighted average conservative ion concentrations. The weighted average pH varied from 4.10 for an Ohio site to 5.50 for an Oregon site and is the type of average generally reported in the literature. When the mean, median, or calculated average pH values were subtracted from the weighted average pH, the differences were from -0.05 to 0.27 for sites east of the Mississippi River. The differences frequently had larger magnitudes for sites west of the Mississippi River. In the extreme, for two Northern Great Plains sites with weighted average pH values of 5.11 and 5.21, the other three types of averages gave pH values higher by 0.76 to 1.11 pH units. With such large differences at some sites, it is important to select the type of average most appropriate for the particular application being considered.

45115 **Observations of aerosol chemical composition and acidity in Northwest and Southeast regions of the US.** Alkezweeny, A.J.; Busness, K.M. (Pacific Northwest Lab., Richland, WA). *Science of the Total Environment;* 39: 125-133(1984). Contract AC06-76RL01830.

Aircraft measurements of atmospheric aerosols and selected trace gases were performed in remote northwestern and rural southeastern regions of the continental US. In the Northwest, the average concentrations of major constituents were sulfate, 0.15 $\mu g/m^3$; nitrate, 0.05 $\mu g/m^3$; ammonium, 0.05 $\mu g/m^3$; and ozone, 33 ppb. The average cloud water pH (of clouds that may form over the region) was calculated to be 4.74; 0.5 g/m^3 liquid water content was assumed. Trace metal concentrations were also measured and used in the discussion as pollutant source tracers. It was concluded that the data from the Northwest may be considered representative of background concentrations. In the Southeast, the average concentrations of major constituents were sulfate, 5.20 $\mu g/m^3$; nitrate, 0.25 $\mu g/m^3$; ammonium, 0.90 μ/m^3; ozone, 63 ppb; and pH 4.78. These large differences in each species concentration reflect the impact of anthropogenic sources in the rural southeastern region of the US.

45116 **Incursion of acid deposition into western North America.** Hinds, W.T. (Battelle Pacific Northwest Labs., Richland, WA). *Environmental Conservation;* 10: No. 1, 53-58(Spr 1983). Contract AC06-76RL01830.

The purpose of this study is to provide a brief assessment of scientific expectations for the western edge of North America in relation to acidic deposition and ensuing biotic effects. The author addresses a series of concerns for the Colorado Rockies, the western portions of the Pacific States, and the western edge of British Columbia. These are all areas with tall mountains, valuable vistas and forests, soft-water lakes and rivers and increasing urbanization. The major conclusions are twofold; first, it is possible that increased acidic deposition will for some decades be associated with localized, rather than region-wide, effects in western North America, and second, it should be possible to locate areas of greatest susceptibility and, by intelligent site-selection, to minimize their exposure to acid precursors from future sources.

45117 **Estimate of wet, dry and total deposition of atmospheric particles and gases to a canopy.** Slinn, W.G.N. (Pacific Northwest Labs., Richland, WA). pp 53 of First international symposium on acid precipitation and the forest ecosystem. Columbus, OH; Ohio State University (1975). (CONF-750552—).

From 1. international conference on acid precipitation and the forest ecosystem; Columbus, OH, USA (12 May 1975).

The processes by which pollutants are transferred from the atmosphere to ground level receptors are generally known as precipitation scavenging and dry deposition. In this report general analyses of these processes described elsewhere by the author are applied to the problem of deposition of particles and gases to a canopy. In the case of precipitation scavenging little change is needed in the general formalism and removal rates are presented as a function of particle size, gas solubility and precipitation properties. For dry deposition to a canopy, estimates are made for the canopy's filtration efficiency and deposition velocities are suggested as a function of this efficiency and as a function of particle size and the sorption of gases by surfaces. The general results are illustrated by estimating wet, dry and total SO_2 and SO_4/sup =/ deposition for a special case.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 43856, 43869, 43891, 45097, 45145, 45179

45118 **(AD-A—154465/9/XAB) Incorporation of Hopkins variable wind model into a population-dose fallout code. Master's thesis.** St. Ledger, J.W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1985. 102p. NTIS, PC A06/MF A01.

Hopkins variable wind fallout model is used to predict the dose and population insult across the United States from a nuclear attack. The dose calculation is performed by two programs written in Fortran V for a CYBER 845 computer. Hopkins hotline locator program was modified to reduce its run time, and it is used to locate the fallout hotline as trace particles are translated to the ground in a spatially varying wind field. The second program analytically smears fallout activity along the hotline. To reduce run time and to match the population model, the dose program uses a computational grid of one degree latitude by one degree longitude. A difference of cumulative normal functions gives the average dose across a grid cell. An analytical method was developed to treat multiple bursts against an area target as one cloud. For the winds of 0000 Universal Time on 16 January 1982, a hypothetical attack against twenty-five air bases and six Minuteman missile fields results in 26.9 million fallout deaths. This calculation used 407 seconds of computer time.

45119 **(AD-A—154469/1/XAB) Analysis of radon and radon progeny in residences: factors that affect their amounts and methods of reduction. Master's thesis.** Little, D.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1985. 94p. NTIS, PC A05/MF A01.

The effectiveness of using an electrostatic precipitator as a means for reducing harmful levels of radon progeny in the home was evaluated. A commercially available precipitator, manufactured by the Honeywell Corporation, was used during the course of the study. The specific model used was the Honeywell Electronic Air Cleaner model number F50A1009. Daughter concentrations were measured by the modified Tsivoglou method. Samples were collected on a 2-inch millipore filter and alpha emissions were measured with a ZnS(Ag) scintillator. A sample collection time of 5 minutes was used. Sample counting intervals of 2-5, 6-20, and 21-30 minutes after sample collection were used. During this study air samples were made using the blower fan and filters alone with no power to the electrostatic precipitator, and with the electrostatic precipitator energized. The reduction in the working level as a result of using the blower fans and filters only was 75%. With the electrostatic precipitator energized, the reduction level rose to 90%. It is therefore concluded that the electrostatic precipitator is an effective means for reducing radon progeny concentrations in the home.

45120 **(AD-A—154721/5/XAB) Model for world-wide fallout in the Northern Hemisphere. Master's thesis.** Grosner, B. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Jan 1985. 101p. NTIS, PC A06/MF A01.

The purpose of this thesis was to develop a model that would predict world-wide fallout in the Northern Hemisphere by modeling the stratospheric-to-tropospheric exchange processes. Inherent in the development of the model was to keep it simple enough to be programed into a personal or home computer. The model is adaptable to the dispersion of debris clouds that are made up of particles in the stratosphere, other than just those from nuclear detonations. The model consists of injecting a radioactive cloud into the stratosphere and allowing it to grow with time. As the cloud reaches the tropopause it is injected to the troposphere using an air mass flux which is a function of latitude and season. The model is dependent on the assumed particle size distribution of the cloud. The model, using the assumed particle size distributions that have been postulated, is compared to an empirical model based on the 1958 nuclear tests of the U.S. and USSR.

45121 **(EGG—10282-1078) Aerial radiological survey of the Indian Point Station and surrounding area, Buchanan, New York. Date of survey: June-July 1984.** (EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.). Apr 1985. Contract AC08-83NV10282. 13p. NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number TI85016907.

An aerial survey was conducted during the period June 28 to July 11, 1984 over a 260-square-kilometer (100-square-mile) area centered on the Indian Point Station in Buchanan, New York. The survey was conducted at an altitude of 45 meters (150 feet) above ground level with line spacings of 76 meters (250 feet). Count rates were converted to exposure rates at 1 meter above the ground. Over most of the survey area exposure rates varied from 8 to 12 microroentgens per hour (μR/h). These results compared favorably with those obtained in a previous survey. Elevated exposure rates were observed within the reactor facility and were attributable to the presence of cobalt-60 and cobalt-58 resulting from routine reactor operations. An anomalous source of gamma ray emissions was seen northeast of the power station. This location was found to be the site of a transshipper of nuclear materials. No other evidence of any man-made activity was observed outside the reactor facility.

45122 **(EML—442) Intercomparison and intercalibration of passive radon detectors in North America.** George, A.C.; Hinchliffe, L.; Fisenne, I.M.; Knutson, E.O. (USDOE Environmental Measurements Lab., New York). May 1985. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017228.

To evaluate the state-of-the-art of radon measurements, three types of passive devices commonly used in North America by several groups involved in radon programs were exposed to two known levels of radon at the Environmental Measurements Laboratory. Although scintillation cells are not passive devices, they were also included in the high radon environment because of their widespread usage. The higher concentration (2500 $Bq.m^{-3}$) was achieved in an environmental chamber with controlled temperature and humidity, while the lower concentration (75 to 250 $Bq.m^{-3}$) was at ambient conditions. Quality control was strictly maintained by continuous measurement of radon concentrations with scintillation cell counters, verified by pulse ionization chamber measurements. After exposure, the devices were returned to the participating laboratories, who then provided the radon concentration as measured by their detectors. The results indicate that most devices appear to be satisfactory with room for improvement. This report discusses possible causes of discrepancies and strongly recommends the need for further intercomparison and intercalibration exercises to assure that the quality of radon measurements continues to improve. This work is part of the program entitled 'International Intercalibration and Intercomparison Programme for Radon, Thoron and Daughters Monitoring Equipment' sponsored by the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) and the Commission of the European Communities (CEC).

45123 **(EML—445) July 1984 and February 1985 radon intercomparison.** Fisenne, I.M.; George, A.C.; Keller, H. (USDOE Environmental Measurements Lab., New York). Aug 1985. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017227.

This report summarizes the results of the July 1984 and February 1985, the seventh and eighth, radon intercomparison exercises held at the Environmental Measurements Laboratory. Twenty-eight organizations, including six US Federal facilities, one national laboratory, four state laboratories, eight universities, six private sector facilities, and three non-US laboratories participated in these exercises. The results indicate reasonable agreement among the participants at the ^{222}Rn concentration level of 35 $pCi.L^{-1}$. 6 figs., 8 tabs.

45124 **(PB—85-190627/XAB) Physical model of the dispersion of a radioactive contaminant in the atmosphere above a heat island.** Tolv, J.A.; Tenchine, D. (Commission of the European Communities, Luxembourg). [1985]. 67p. (EUR—9213-EN). NTIS, PC E04/MF E04.

The atmospheric boundary layer is simulated in a water flume. Ground heating is applied locally reproducing the heat flux

of an urban region. Fission products for which internal heat source is neglected are simulated by horizontal plumes at pHs different from the original pH of the flume. The main results of the study concern: The characterization of the internal boundary layer downstream of the leading edge of the heated ground; and comparison of the concentration distributions of pollutants with and without surface heating. A transposition of the results, expressed in terms of global parameters, enables information on the heat island effect due to urban regions on the dispersion of contaminants in the atmosphere to be obtained.

45125 (RRC—55, pp 246-253) **Post accident environmental monitoring.** Nagel, E. (Eidgenoessisches Institut fur Reaktorforschung, Wuerenlingen, Switzerland). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

In this paper it is the most probable accident i.e., a release of an inadmissible amount of radioactivity to the atmosphere that has been discussed. An event of this kind may occur in a facility of a research center as well as in a power plant. The way to meet such a situation will be fundamentally the same. It shows task and importance of a well prepared emergency team for environmental monitoring in every nuclear plant. 4 figs. (DT)

45126 **(SCPRI-RM—4-1984) Monthly results of measurements, April 1984.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). May 1984. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751151.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--2-1984 report).

45127 **(SCPRI-RM—5-1984) Monthly results of measurements, May 1984.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jun 1984. 43p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751152.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--2-1984 report).

45128 **(SCPRI-RM—6-1984) Monthly results of measurements, June 1984.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jul 1984. 43p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751153.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--2-1984 report).

45129 **(SCPRI-RT—2-1984) 2. Quaterly progress report 1984. [Radiation protection research program].** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1984. 37p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751154.

This report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the state of surveillance and assistance operations on work sites and the state of incidents along the three months; a bibliographic selection is also presented.

45130 **(UCRL—92335) Optimization aspects of the ARAC real-time radiological emergency response system.** Taylor, S.S.; Sullivan, T.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 16p. (CONF-8509130—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016945.

From Workshop on real-time computing of the environmental consequences of an accidental release to atmosphere from a nuclear installation; Luxembourg, Luxembourg (17 Sep 1985).

The Atmospheric Release Advisory Capability (ARAC) project at the Lawrence Livermore National Laboratory responds to radiological emergencies throughout the Continental United States. Using complex three-dimensional dispersion models to account for the effects of complex meteorology and regional terrain, ARAC simulates the release of radioactive materials and provides dispersion, deposition, and dose calculations that are displayed over local geographic features for use by authorities at the accident/release site. ARAC's response is ensured by a software system that (1) makes optimal use of disperaion models, (2) minimizes the time required to provide projections, and (3) maximizes the fault-tolerance of the system. In this paper we describe ARAC's goals and functionality and the costs associated with its development and use. Specifically, we address optimizations in ARAC notifications, meteorological data collection, the determination of site- and problem-specific parameters, the generation of site-specific topography and geography, the running of models, and the distribution of ARAC products. We also discuss the backup features employed to ensure ARAC's ability to respond.

45131 **(UCRL—93116) Real-time computing of the environmental consequences of an atmospheric accidental release of radioactive material: user's point of view.** Boeri, G.; Caracciolo, R.; Dickerson, M. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 16p. (CONF-8509130—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016438.

From Workshop on real-time computing of the environmental consequences of an accidental release to atmosphere from a nuclear installation; Luxembourg, Luxembourg (17 Sep 1985).

All calculations of the consequences of an atmospheric release must start with atmospheric dispersion calculations. Time factors make external and inhalation dose estimates of immediate concern closely followed by ground contamination of land, pastures and onch agricultural crops. In general, the difficulties in modeling the source term and atmospheric transport and diffusion account for most of the error in calculating the dose to man. Thus, sophisticated treatment of the dose part of the calculating is not usually justified, though the relative distribution of dose in individual organs may be needed for correct decision marking. This paper emphasizes the atmospheric transport and diffusion part of the dose estimate and relates how this calculation can be used to estimate dose. 12 refs.

5005 Site Resource And Use Studies

45132 **(ORNL/TM—9588) Analysis of indoor air quality data from East Tennessee field studies.** Dudney, C.S.; Hawthorne, A.R. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85013213.

This report presents the results of follow-up experimental activities and data analyses of an indoor air quality study conducted in 40 East Tennessee homes during 1982-1983. Included are: (1) additional experimental data on radon levels in all homes, repeat measurements in house No. 7 with elevated formaldehyde levels, and energy audit information on the participants' homes; (2) further data analyses, especially of the large formaldehyde data base, to ascertain relationships of pollutant levels vs environmental factors and house characteristics; (3) indoor air quality data base considerations and development of the study data base for distribution on magnetic media for both mainframe and desktop computer use; and (4) identification of design and data collection considerations for future field studies. A bibliography of additional publications related to this effort is also presented.

5006 Regulations

REFER ALSO TO CITATION(S) 43952, 45123

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 43965, 43971, 45164

45133 **(IAEA-R—2866-F) Work within the coordinated programme on studying the physical and isotopic behaviour of soil moisture in the zone of seration. Final report for the period 1 April 1981-31 October 1984.** Fontes, J.C. (International Atomic Energy Agency, Vienna (Austria)). Jan 1985. 77p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85701952.

Two similar studies have been carried out in South Algeria (Beni Abbes) and South Tunisia (Gabes) to evaluate the actual rate of infiltration and evaporation under arid and semi-arid conditions. The principle was to drill cores within the unsaturated zone, if possible up to the phreatic level, to extract the moisture from the soil sample. Special care has been taken in collection of representative soil samples in order to avoid any change in the isotopic composition of the soil water. On each sample the physical parameters (weighted water content, bulk density, volumetric water content, porosity) were measured or estimated. On the water extracted electric conductivity, sulphate and chlorine concentration, oxygen-18 and deuterium content, and tritium activity were measured. The influence of evaporation processes was demonstrated to great depth - 7 metres in Tunisia and 11 metres in Algeria. The application of Barnes and Allison's model of stable isotope profiles in the unsaturated zone led to an estimation of 1.4 mm/year for the evaporation rate.

45134 **Evaluation of vaginal implants for mule deer.** Garrott, R.A.; Bartmann, R.M. (Environmental Sciences Group, Los Alamos, NM). *Journal of Wildlife Management;* **48**: No. 2, 645-648(1984). Contract W-7405-ENG-36.

It is difficult to obtain information on the biology of the mule deer (Odocoileus hemionus) during the first several months of life because of the seclusive nature of fawns. Radio-transmitter implants were placed in the vaginas of mule deer to facilitate determining the time and location of parturition and to evaluate the effects on dams in the Piceance Basin, northwest Colorado.

45135 **Movements and dispersal of bobcats in East Tennessee.** Kitchings, J.T.; Story, J.D. (Oak Ridge National Lab., TN). *Journal of Wildlife Management;* **48**: No. 3, 957-961(1984). Contract W-7405-ENG-26.

In spring 1978, a study was initiated to acquire data on home range, spatial distribution, behavior, and movement of bobcats on the Department of Energy's Oak Ridge National Environmental Research Park (NERP). The objective of this paper is to describe the movements of 15 adult and juvenile animals from March 1978 through June 1981 with particular emphasis on dispersal of young bobcats.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 45094

45136 **(CONF-8310249—Summ.) 6th International symposium on environmental biogeochemistry. Final report. Summary.** (New Mexico Inst. of Mining and Technology, Socorro (USA)). 1983. Contract FG04-82ER60088. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85014690.

From 6. international symposium on environmental biogeochemistry; Santa Fe, NM, USA (10 Oct 1983).

The theme of the symposium was "Planetary Ecology". Papers were focused on the relationship of biological evolution, specific environments, nutrient cycles, and organisms to the development of earth chemistry. Papers have been individually abstracted for inclusion in the data base. (ACR)

45137 **(EPRI-CS—4175) Portable gas chromatograph for polychlorinated biphenyl (PCB) analysis. Final report.** Picker, J.E.; Colby, B.N.; Trujillo, S.M.; Burns, E.A. (S-Cubed, San Diego, CA (USA)). Jul 1985. 55p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920789.

A portable gas chromatograph has been developed with the specific aim to permit field characterization of PCBs in dielectric fluids and contaminated soils. Design features incorporated into this analyzer, called the PCBA-102, include (1) a rugged, portable, field-usable gas chromatograph, having a wide linear dynamic range, (2) a special on-board microprocessor incorporating GC pattern recognition software to identify any of four different Aroclors in the sample at concentrations of 10 to 1000 ppM, and (3) sample preparation and operational procedures to permit use by personnel with limited operator experience. The PCBA-102 automates the EPA/ASTM regulatory analysis procedures for the characterization of Aroclors 1016, 1242, 1254, and 1260. Special easy-to-use sample preparation procedures have been developed and associated sampling kits are provided which facilitate the quantitative extraction of PCBs from the dielectric fluids and contaminated soils prior to analysis using the PCBA-102. Specificity and sensitivity of the PCBA-102 eliminates the problems attendant with non-specific chloride screening analyzers (specifically, the significantly high results when impurities are present, e.g., askarel analyses). This report provides information on the instrument design, sample preparation procedures, data handling, and the results of the instrument validation studies. A preliminary economic analysis was performed showing that with a total number of samples per year of around 2500 (e.g., 50 samples per week) the operating cost for Aroclor analysis was around $11 per sample for PCBs in transformer fluids and $13 a sample for PCBs in soils.

45138 **(RISO-M—2501) Illustration of the present capabilities of the ECCES program system.** Christensen, B.; Mortensen, P.B.; Petersen, T. (Risoe National Lab., Roskilde (Denmark)). Apr 1985. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752503.

This report describes the status of the development of the ECCES program system. The capabilities of the model are described together with the results of a scenario calculation. Furthermore a series of calculations are shown in order to demonstrate some phenomena concerning the soil chemistry and plant models.

45139 **Effects of atmospheric deposition on forest nutrient cycles.** Johnson, D.W.; Richter, D.D. (Oak Ridge National Lab., TN). *Tappi;* **67**: No. 1, 82-85(Jan 1984). Contract W-7405-ENG-26.

Atmospheric depositions of nitrogen, sulfur, and hydrogen ion have probably increased over the last few decades in many parts of the world. Because most forests are deficient in nitrogen, such increases can be beneficial. Little is known about the changes (if any) in atmospheric deposition of phosphorus and base cations, but there are indications that base cation inputs have declined recently. This, coupled with atmospheric H^+ inputs (acid deposition) and internal H^+ generation within forest ecosystems, results in a net loss of cations from most forest ecosystems. The extent to which an individual cation is leached depends upon the relative abundance of that cation on soil exchange sites and its selectivity for adsorption. Thus, scarce or tightly bound cations may be conserved despite very intense leaching rates, while more abundant or loosely bound cations are leached. In extremely acid soils, all base cations may be conserved, while hydrogen and aluminum ions are leached. 2 tables.

45140 **Estimation of survival rates from band recoveries of mule deer in Colorado.** White, G.C.; Bartmann, R.M. (Los Alamos National Lab., NM). *Journal of Wildlife Management;* **47**: No. 2, 505-511(1983). Contract W-7405-ENG-36.

An attempt has been made to determine the survival rate of mule deer in the White River drainage basin in northwestern Colorado. During five winters, 1972-76, 1923 mule deer were trapped

and marked. Survival rates were determined at yearly intervals. A FORTRAN program was used to perform the analysis.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 43869, 43887, 43890, 43891, 43892, 44748, 45097, 45125, 45126, 45127, 45128, 45129, 45174, 45176, 45179

45141 (AECL—8254) Migration of radionuclides in porous media. Analysis of experimental data. Moltyaner, G.L.; Paniconi, C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1984. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701949.

One- and three-dimensional solutions based on the classical advection-dispersion equation have been developed and classified for the analysis of radionuclide transport in unconsolidated porous materials. The one-dimensional solutions have been applied for interpretation of experimental data obtained from radio-tracer tests with laboratory and field columns whereas both types of solutions were employed for interpretation of the field tracer test data.

45142 (CEGB-RD-TPRD/B—0416/N84) Experimental study of the time dependence of uptake from soil of ^{137}Cs, ^{106}Ru, ^{144}Ce and ^{99}Tc into green vegetables, wheat and potatoes. Grogan, H.A.; Bell, J.N.B.; Minski, M.J.; Nair, S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1984. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701872.

In this study the experimental data were analysed using the CEGB's dynamic foodchain model, and were used to validate the relevant part of the model structure, to produce model-specific input data and to identify possible future improvements to the model structure. The root uptake of the specified radionuclides was studied and the concentration levels measured. The data were analysed using a simplified version of the general model. The compartment system incorporated within the model was shown to be capable of reproducing the data for ^{137}Cs, ^{106}Ru and ^{144}Ce to an extent sufficient to justify its use in ingestion radiological dose assessments, but to be less successful in fitting the ^{99}Tc data. The analysis resulted in the production of a well validated set of model-specific input data relevant to UK conditions and agricultural practice differing significantly from values obtained from global literature surveys. Possible future improvements to the model structure were also identified, aimed at providing improved estimates of crop contamination levels for timescales in excess of those considered in this study.

45143 (CONF-840168—) Technical papers presented at a DOE meeting on criteria for cleanup of transuranium elements in soil. (USDOE Assistant Secretary for Defense Programs, Washington, DC; USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). Sep 1984. 233p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85015564.

From DOE meeting on criteria for clean-up of transuranium in elements and soil; Germantown, MD, USA (17 Jan 1984).

Transuranium element soil contamination cleanup experience gained from nuclear weapons accidents and cleanup at Eniwetok Atoll was reviewed. Presentations have been individually abstracted for inclusion in the data base. (ACR)

45144 (DOE/ER/60141—T1) Radon transport from uranium mill tailings via plant transpiration. Final report. Lewis, B.A.G. (Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering). 1985. Contract AC02-83ER60141. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017357.

Radon exhalation by vegetation planted on bare or soil-covered uranium mill wastes was studied based on an assumption that radon transport from soil to atmosphere via plants takes place in the transpiration stream. Results show that radon exhalation by plants is inversely related to water transpired, primarily a dilution effect. Radon released appeared directly related to leaf area, suggesting that radon is carried into the plant by mass flow in water; however, once within the plant, radon very likely diffuses through the entire leaf cuticle, while water vapor diffuses primarily through open stomates. Application of a computerized model for water transpiration to radon exhalation is not immediately useful until the role of water in radon transport is defined throughout the continuum from rooting medium to the atmosphere. Until then, a simple calculation based on leaf area index and Ra-226 concentration in the rooting medium can provide an estimate of radon release from revegetated wastes containing radium.

45145 (EML—444) Worldwide deposition of ^{90}Sr through 1983. Larsen, R.J. (USDOE Environmental Measurements Lab., New York). Jul 1985. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85017599.

The total deposition of ^{90}Sr in the Northern Hemisphere during 1983 was 0.3 PBq, while the total deposition in the Southern Hemisphere was 0.2 PBq making the total deposition on the surface of the earth during 1983 0.5 PBq. This is the lowest total yearly deposit since the initiation of the Environmental Measurements Laboratory's global fallout program in the late 1950's. The worldwide cumulative deposit decreased to 365.6 PBq. The last reported nuclear detonation in the atmosphere occurred at the Lop Nor test site in China on October 16, 1980. 13 refs., 9 figs., 6 tabs.

45146 (GSCan-Bull—360) Natural background radiation in Canada. Grasty, R.L.; Carson, J.M.; Charbonneau, B.W.; Holman, P.B. (Geological Survey of Canada, Ottawa, Ontario). 1984. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701960.

Published airborne gamma ray survey data from 33 areas of Canada were used to compile information on the average ground level exposure from natural radiation. The exposures at ground level were calculated from the surface concentrations of potassium, uranium and thorium. The highest levels of radioactivity were found in northern Canada and were generally related to granitic rocks; the lowest levels with the Athabasca sandstone. Summer outdoor exposure rates have a population-weighted average of 3.7 +- 2.3 $\mu R.h^{-1}$, of which 48 percent orginated from potassium, 43 percent from the thorium series and 9 percent from the uranium series. This low level of radioactivity, compared to worldwide data, has resulted from erosion of a geologically old continental crust in which radioactivity decreases with depth. When seasonal variations of soil moisture and snow cover are considered, the annual population-weighted average outdoor exposure rate decreases to 2.8 +- 1.7 $\mu R.h^{-1}$ corresponding to an annual outdoor dose-equivalent of 150 +- 90 μSV. Factors increasing the annual outdoor dose-equivalent are cosmic radiation (320 +- 30 μSV) and the internal radioactivity of the body (190 μSV). Using the ratio between indoor and outdoor values for worldwide published data, the average annual Canadian whole-body dose-equivalent from all sources of natural radiation is estimated to be 690 +- 130 μSV.

45147 (INFO—0096) Review of existing instrumentation and evaluation of possibilities for research and development of instrumentation to determine future levels of radon at a proposed building site. (DSMA Atcon Ltd., Toronto, Ontario (Canada); Atomic Energy Control Board, Ottawa, Ontario (Canada)). 18 Jan 1983. 75p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701950.

The rate at which radon enters houses from the soil depends on the pressure differential between the house and the soil, the resistance of the soil to gas movement, and the radon release rate of the soil near the house. The pressure differential between house and soil is caused by wind forces and temperature differences, which depend on the size of the building and the season, and are therefore almost independent of the site location. The soil resistance (permeability) and radon release rate are site specific, and a computer study of radon movement through the soil suggested that these parameters could be combined to give a Radon Index Number (RIN) for a site that would be proportional to the radon entry rate into a typical house. Regional RIN estimates would be produced using existing airborne gamma survey maps to estimate average soil radon release rate, plus agricultural soil classification maps to estimate permeability. Area RIN estimates would be produced using portable gamma spectroscopy equipment to estimate soil radon release rates over an area, plus simple soil grain size analysis techniques to

estimate permeability. Site RIN estimates would be produced using laboratory techniques to measure both the radon release rate and the permeability of several undisturbed soil core samples taken at depths over the site. These would provide the most accurate value of RIN possible for a given site.

45148 **Biotic transport of radionuclides from a low-level radioactive waste site.** Kennedy, W.E. Jr.; Cadwell, L.L.; McKenzie, D.H. (Pacific Northwest Lab., Richland, WA). *Health Physics;* **49**: No. 1, 11-24(Jul 1985).

The objective of this work was to evaluate the relevance of potential biological transport processes in the assessment of potential impacts at low-level waste (LLW) disposal sites. As part of this effort, the authors developed an order-of-magnitude estimate for potential dose to man resulting from biological transport by burrowing animals and by plant translocation at a reference low-level waste in the arid west. They also made comparative dose-to-man estimates for a more commonly considered human intrusion exposure scenario. Parameter values for defining a reference arid LLW disposal site and biotic transport processes are based on data reported in current literature. The estimates of the dose-to-man resulting from biotic transport are of the same order of magnitude as those resulting from a more commonly evaluated human intrusion scenario. The results indicate that long-term biological transport processes have the potential to influence LLW site performance, and should be carefully evaluated as part of the impact assessment process.

45149 **Mapping pocket gopher burrow systems with expanding polyurethane foam.** Felthauser, M.; McInroy, D. (Los Alamos National Lab., NM). *Journal of Wildlife Management;* **47**: No. 2, 555-558(1983).

The impetus for this study arose from the need to isolate buried chemical and radioactive waste from burrowing animals. In a study of barrier materials that inhibit burrowing by pocket gophers (Thomomys spp.) into waste material, it was necessary to map tunnel systems as a function of depth and soil type. A method of mapping burrow systems was needed that would be economical, portable, useful in a variety of soil types, and give accurate, permanent records of burrow configurations. A method is described for injecting an expanding polyurethane foam to map burrow systems in situ.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 43673, 43956, 45147

45150 **(DP-MS—85-34) Sludge application program at the Savannah River Plant.** Corey, J.C.; Lower, M.W.; Davis, C.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 39p. (CONF-8506167—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85015828.

From Forest land applications symposium; Seattle, WA, USA (25 Jun 1985).

Since 1980 a research program has been conducted at the Savannah River Plant to evaluate the use of domestic sewage sludge to enhance forest productivity. The objectives of the program have been to determine the cost effectiveness and environmental impact of using sewage sludge as a soil conditioner and slow-release fertilizer. The potential impacts of sludge application on nutrient cycling, organic carbon budgets, forest wildlife, and biomass production have been studied. Soil, soil water, groundwater, and stand biomass samples have been analyzed to monitor the availability and movement of nutrients and metals. Remote sensing techniques have been applied to the plots to see if they have large scale application to biomass determinations. Results of the study have been used to develop guidelines for land application of domestic sewage sludge.

45151 **(NP—5901714) Hazardous waste sites: descriptions of sites on current National Priorities List, October 1984.** (Environmental Protection Agency, Washington, DC (USA)). Dec 1984. 546p. NTIS, PC A23/MF A01. File Number DE85901714.

This document consists of descriptions of the 538 sites on the National Priorities List (NPL). The "Conditions at listing" section describes the site when it was first proposed for the NPL. The "Status" section describes the site at about the time it was placed on the NPL. The "Status" section describes the site at about the time it was placed on the NPL. Subsequent notations are based on a new categorization system EPA instituted in October 1984 to indicate progress at sites. In the past, EPA categorized NPL sites based on the type of response at each site (Fund-financed, enforcement, and/or voluntary action). EPA is now expanding the prior categorization system in two ways: First, Federal enforcement actions are separated from State enforcement actions. Second, the status of site cleanup activities is designated by three new cleanup status codes. The codes identify sites where significant response activities are underway or completed.

5106 Regulations

REFER ALSO TO CITATION(S) 43662, 43956

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 43673, 43885, 43965, 45133, 45191

45152 **(DOE/BP—344) Effects of flow on the migratory behavior and survival of juvenile fall and summer chinook salmon in John Day Reservoir. Annual report, FY 1983.** Miller, D.R.; Sims, C.W. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). Jun 1984. Contract AI79-83BP39643. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85015779.

The effects of instream river flow on the passage time, survival, and migrational behavior of juvenile fall and summer (O-age) chinook salmon in John Day Reservoir is being studied. In 1983, the final year of juvenile sampling in the reservoir, research activities continued to refine flow/travel time relationships and distributional behavior of O-age chinook salmon. Fifteen groups (72,559 fish) of marked O-age chinook salmon were wire-tagged, branded, and released into the tailrace at McNary Dam, and thirty-two groups (22,206 fish) were branded and released into the reservoir at various other sites. Sampling at John Day Dam, utilizing the airlift pump system in the B and C slots of Turbine Intake Unit 3, captured 82,698 subyearling chinook salmon including 640 mark recoveries. Additional marks (458) were recovered from purse seine samples taken at various sites throughout the reservoir. Weekly mean fork lengths of O-age chinook salmon captured at McNary and John fsm Dams and in the reservoir by purse seine ranged from 103 mm in mid-June to 166 mm in mid-December. Fish captured at the John Day Dam monitoring facility and by purse seine throughout the reservoir were in excellent condition. Preliminary analysis of stomach samples taken in 1982 and 1983 from purse seine catches indicates active feeding is taking place. The average passage time of the fastest moving marked O-age chinook salmon from McNary Dam to John Day Dam was 11 days (based on 25th percentile of mark recaptures). The average reservoir residence time was 22 days. Regression analysis was used to develop a description of the relationship of river flow to the rate of downstream movement of O-age chinook salmon in John Day Reservoir in 1983. The slope of this line and the correlation coefficient (R) were not significantly different from zero.

45153 **(DOE/BP—347) Smolt passage behavior and flow-net relationships in the forebay of John Day Dam. Annual report, 1983.** Giorgi, A.E.; Stuehrenberg, L.C. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.; USDOE Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife). Apr 1984. Contract AI79-83BP39644. 158p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85016331.

During 1983, the research program had three separate but complementary phases - monitoring current patterns in the forebay, defining fish distribution with purse seine sampling, and describing

the migration routes of salmonid smolts using radio tracking techniques. Preliminary results from the radio-tracking and purse seining operations in FY 1983 suggest that the discharge from the John Day River and the turbid plume it forms in the forebay may have a pronounced effect on the distribution of smolts, especially chinook and sockeye salmon, as they approach the dam. The implication of these data is that the plume may be shunting salmon toward the Washington (spill) side of the river where they would be more susceptible to spill passage. This resulted in higher spill passage of tagged chinook salmon than the proportion of water being spilled. In contrast, sillway passage of steelhead not influenced by the plume is approximately the same as the proportion of water being spilled. These findings are based on limited data and must be considered preliminary at this time. Data describing the current patterns have just recently been reduced to a usable format and have not yet been correlated with findings from radio tracking and purse seining. Such data will be icorporated into an overall analysis of the relations of current patterns and John Day River discharge to fish migration patterns. Representative examples of prevailing current patterns during the spring migration have been completed and are included in this document. 10 refs., 14 figs., 6 tabs.

45154 **(DOE/BP—348) Study to determine the biological feasibility of a new fish tagging system. Annual report, 1983.** Prentice, E.F.; Park, D.L. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). May 1984. Contract AI79-83BP11982. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015781.

Pacific salmon are tagged or marked as a critical part of numerous research and management studies. A new tag called the PIT (passive integrated transponder) tag measuring 7.5 mm long by 1.5 mm in diameter has a great potential for marking fish if it proves to be biologically compatible. A study was conducted to evaluate the potential of the PIT tag for marking salmonids. The objectives of the first year's research were to determine: (1) the anatomical areas in which the tag could be placed; (2) tissue response to the tag; and (3) tag retention. Juvenile coho, Oncorhynchus kisutch, and chinook O. tshawytscha, salmon and adult chinook salmon held at Manchester or Big Beef Creek, Washington, were used as test animals. Juvenile salmon were injected with sham PIT tags in the body cavity and opercular, dorsal, and caudal masculature. The fish ranged in length from 126 to 212 mm. Observations based on three tests, from 44 to 102 days long, indicated that the dorsal musculature and body cavity were the best locations to inject the tag from biological and social standpoints. Sham PIT tags were injected into the nose; body cavity; and opercular, dorsal, and caudal musculature of jack chinook salmon. The test was conducted for 23 days. Although all five anatomical areas were acceptable from a technical standpoint, the body cavity appeared to be the best area for tag placement. Initial test results with the Sham PIT tag were very encouraging. Apparently the PIT tag can be successfully injected into and carried by salmon, making it a potentially useful tool for fisheries biologists. 5 refs., 8 figs., 6 tabs.

45155 **(DOE/BP—364) Hydroacoustic monitoring of downstream migrant salmon and steelhead at Wells Dam in spring 1984. Annual report, 1984.** Raemhild, G.A.; Johnson, G.E.; Sullivan, C.M. (BioSonics, Inc., Seattle, WA (USA)). Dec 1984. Contract AI79-84BP13099. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016327.

The downstream migration of salmon and steelhead in spring 1984 at Wells Dam on the mid-Columbia River was monitored using hydroacoustics. The primary objective of this research was to document run timing and describe the distribution of smolts at the dam. The study occurred from April 2 to June 15, 1984. Four transducers were deployed at the bases of pier noses at Turbines 3, 5, 7, and 9 and aimed up 24° into the forebay. They were sampled once every hour, 24 hours per day, for 75 days. An index of fish passage was reported daily to the Water Budget Center in Portland, Oregon. This index was computed as follows. For each 24-h period, separate fish passage rates (number/time) at each of the four sampling locations were estimated by dividing the sum of the "weighted" fish detections by total sample time. These four values then were averaged to produced the daily index (number/day/location). The first substantial increase in fish passage occurred on April 25, 1984 due to the chinook released from the Winthrop hatchery on April 23. During May, run timing was fairly uniform except for peaks on May 2, 14, 18, and 22. The unexpected peak in run size that occurred from May 29 to June 2 could have been caused by juvenile mountain whitefish. Although the proportion of each species varied, chinook passage probably peaked in late April, and steelhead in the first two weeks of May; sockeye passage was variable throughout the study. The data indicated that most downstream migrants were distributed high in the water column and toward the western end of the dam. Average hourly passage rates for day and night were similar, but more fish passed the dam during the longer period of daylight than the shorter period of darkness. 7 refs., 13 figs.

45156 **(DOE/BP—375) Development of an effective transport media for juvenile spring chinook salmon to mitigate stress and improve smolt survival during Columbia River fish hauling operations. Final report, 1985.** (Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center). Feb 1985. Contract AI79-82BP35460. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016339.

Selected transport media consisting of mineral salt additions (Na^+, Cl^-, Ca^{++}, PO_4^{-3}, HCO_3^-, and Mg^{++}), mineral salts plus tranquilizing concentrations of tricaine methane sulfonate (MS-222), or MS-222 alone were tested for their ability to mitigate stress and increase smolt survival during single and mixed species hauling of Columbia River spring chinook salmon (Oncorhynchus tshawytscha) and steelhead trout (Salmo gairdneri). Successful stress mitigation was afforded by several formulations as indicated by protection against life-threatening osmoregulatory and other physiological dysfunctions, and against immediate and delayed hauling mortality. Effects on the seawater survival and growth of smolts hauled in transport media were used as the overall criterion of success. Of the fourteen chemical formulations tested, 10 ppM MS-222 emerged as top-rated in terms of ability to mitigate physiological stress during single and mixed species transport of juvenile spring chinook salmon at hauling densities of 0.5 or 1.0 lb/gallon. Immediate and delayed mortalities from hauling stress were also reduced, but benefits to early marine growth and survival were limited to about the first month in seawater. The two physical factors tested (reduced light intensity and water temperature) were generally less effective than mineral salt additions in mitigating hauling stress, but the degree of protection afforded by reduced light intensity was nevertheless judged to be physiologically beneficial. 36 refs., 1 fig., 19 tabs.

45157 **(DOE/BP—382) Feeding activity, rate of consumption, daily ration and prey selection of major predators in the John Day pool. Annual report, 1983.** Gray, G.A.; Palmer, D.E.; Hilton, B.L.; Connolly, P.J.; Hansel, H.C.; Beyer, J.M.; Sonnevil, G.M. (Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center). Feb 1985. Contract AI79-82BP34796. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85015780.

This report summarizes activities in 1983, the second of a five year study to determine the extent of predation by resident populations of native and introduced fishes on juvenile salmonids in John Day Reservoir. As in 1982, catches of northern squawfish (Ptychocheilus oregonensis) were highest in areas adjacent to dams; percent by weight of juvenile salmonids in the diet was up to 89.7% higher in these areas. Catches of walleyes (Stizostedion vitreum vitreum) were greatest outside restricted zones (700 to 900 m above and below the dams) in spring of both 1982 and 1983. Percent by weight of juvenile salmonids in walleyes collected in 1983 was generally higher at McNary tailrace and lower at Irrigon and John Day tailrace than in 1982. Smallmouth bass (Micropterus dolomieui) was the most common species collected and contained few salmonids in 1983. Results of the diet analysis for channel catfish (Ictalurus punctatus) varied substantially between 1982 and 1983 as a result of eliminating the John Day River sampling transect and increasing sampling effort at McNary tailrace, Irrigon, and John Day tailrace. The beach seine and boat electroshocker were effective gears for evaluating prey abundance. Data obtained to estimate relationships between fork length of juvenile chinook salmon (Oncorhynchus tshawytscha) and other body or bone measurements indicated that body length predicted fork length best, followed by cleithrum, dentary, and opercle measurements. Digestion over time

was estimated for 162 northern squawfish fed juvenile salmonids at temperatures ranging from 10 to 20 C. 1 ref., 7 figs., 31 tabs.

45158 **(DOE/BP—35097-1) Abundance and distribution of walleye, northern squawfish and smallmouth bass in John Day Reservoir and tailrace. Annual progress report, 1983.** Nigro, A.A.; Willis, C.F.; Beamesderfer, R.C.; Elliott, J.C.; Uremovich, B.L. (Oregon Dept. of Fish and Wildlife, Corvallis (USA)). Apr 1985. Contract AI79-82BP35097. 111p. NTIS, PC A06/MF A01. File Number DE85016233.

Walleye, northern squawfish and smallmouth bass abundances were estimated in portions of John Day Reservoir and tailrace using a multiple mark and recapture method. Sampling was conducted from March 28 to September 23, 1983, using gill nets, trap nets, boat electrofishing, angling and an angler survey. A total of 1808 walleye, 6423 northern squawfish and 974 small mouth bass were collected. Abundance was estimated using a modified Schnabel estimator. Discrete populations were defined according to observed movements of recaptured and radiotagged fish. Abundance estimates were corrected for angler harvest, size selectivity by gear and recruitment due to growth during sampling. In addition, the likelihood of biases resulting from differential mortality of marked fish and tag loss was examined. Abundances of walleye with fork lengths greater than 250 mm were estimated as 6877 below John Day Dam and 9,463 in the upper John Day pool. Extensive movements by walleye within pools were observed. Angler harvest of walleye between May 25 and September 6 was estimated as 527 in John Day tailrace and 465 in McNary tailrace. Abundances of northern squawfish with fork lengths greater than 250 mm were estimated to be 32,126 below John Day Dam, 10,841 forebay and 27,771 in upper John Day pool. The estimated number of northern squawfish in the McNary tailrace boat restricted zone after cessation of spill (July 2) was twice the estimated abundance during spill (March 28-July 1). Smallmouth bass abundance was estimated as 1087 below John Day Dam, 1501 in John Day forebay and 3,450 in upper John Day pool. 16 refs., 32 figs., 47 tabs.

45159 **(DOE/BP/10068—1) Biological and physical inventory of Clear Creek, Orofino Creek, and the Potlatch River, tributary streams of the Clearwater River, Idaho. Final report.** Johnson, D.B. (Nez Perce Tribe, Lapwai, ID (USA). Fisheries Resource Management). May 1985. Contract AI79-83BP10068. 317p. NTIS, PC A14/MF A01; GPO Dep. File Number DE85016237.

Clear Creek, Orofino Creek, and Potlatch Creek, three of the largest tributaries of the lower Clearwater River Basin, were inventoried during 1984. The purpose of the inventory was to identify where anadromous salmonid production occurs and to recommend enhancement alternatives to increase anadromous salmonid habitat in these streams. Anadromous and fluvial salmonids were found in all three drainages. The lower reach of Clear Creek supported a low population of rainbow-steelhead, while the middle reach supported a much greater population of rainbow-steelhead. Substantial populations of cutthroat trout were also found in the headwaters of Clear Creek. Rainbow-steelhead and brook trout were found throughout Orofino Creek. A predominant population of brook trout was found in the headwaters while a predominant population of rainbow-steelhead was found in the mainstem and lower tributaries of Orofino Creek. Rainbow-steelhead and brook trout were also found in the Potlatch River. Generally, the greatest anadromous salmonid populations in the Potlatch River were found within the middle reach of this system. Several problems were identified which would limit anadromous salmonid production within each drainage. Problems affecting Clear Creek were extreme flows, high summer water temperature, lack of riparian habitat, and high sediment load. Gradient barriers prevented anadromous salmonid passage into Orofino Creek and they are the main deterrent to salmonid production in this system. Potlatch River has extreme flows, high summer water temperature, a lack of riparian habitat and high sediment loads. Providing passage over Orofino Falls is recommended and should be considered a priority for improving salmonid production in the lower Clearwater River Basin. Augmenting flows in the Potlatch River is also recommended as an enhancement measure for increasing salmonid production in the lower Clearwater River Basin. 18 refs., 5 figs., 85 tabs.

45160 **(DOE/BP/11196—1) Effects of handling and crowding on the stress response and viability of chinook salmon parr and smolts. Completion report, 1984.** Congleton, J.L.; Bijornn, T.C.; Burton, B.H.; Watson, B.D.; Irving, J.I.; Ringe, R.R. (Idaho Univ., Moscow (USA). Cooperative Fishery Research Unit). Feb 1985. Contract AC79-83BP11196. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85016229.

Transportation of migrating chinook salmon smolts from Snake River dams to the Columbia River estuary has not reversed a downward trend in Idaho stocks of this species that first became apparent in the late 1960s. Poor survival of transported smolts may be a consequence of physiological responses to stressful events during collection and transportation. This study was undertaken to evaluate the intensity of stress responses in transported smolts, to determine if stress responses decrease the viability of transported smolts, and to investigate ways of avoiding or mitigating stressful events during transportation. 34 refs., 58 figs., 13 tabs.

45161 **(FWS/OBS—82/11.27) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic). White shrimp.** Muncy, R.J. (Mississippi State Univ., Mississippi State (USA). Mississippi Cooperative Fish and Wildlife Research Unit; Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). Sep 1984. 26p. NTIS, PC A03/MF A01. File Number DE85901730.

The white shrimp, Penaeus setiferus, is the most important commercial species in the Southeastern United States. It serves an important ecological role as food for other large invertebrates and fishes. Major bait industry is in northeast Florida and Georgia. Spawning occurs offshore within 9-m depth contour where salinities are at least 27 ppt. In spring, postlarval shrimp move with tidal currents into inshore estuarine waters. Juvenile white shrimp prefer shallow organic-rich substrate with low salinities (1-10 ppt). Nearshore soft sediment areas correlated well with white and brown shrimp distributions. Water temperature influences spawning, growth, habitat selection, emigration, and mortality. Low winter temperatures have greatly affected survival, recruitment, and harvest in the South Atlantic fishery. Maintaining suitable nursery grounds is a major concern for the furture of the fishery. 66 refs., 2 figs.

45162 (INIS-BR—279, pp 36-44) **Water leak detection in the cooling system of the blast furnace walls, by using radiotracer techniques.** Aoki, P.E.; Rocca, H.C.C.; Castagnet, A.C.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1984. NTIS (US Sales Only), PC A10/MF A01. File Number DE85781265. (CONF-8408159—Vol.4).

From 4. Japan-Brazil symposium on science and technology; Rio de Janeiro;Sao Paulo, Brazil (6 Aug 1984).

The walls of a blast furnace are cooled by water that circulates through a system of copper plates inserted in the reflactory lining. These plates are fed by two independent annular pipes (or distribution rings) located around the furnace at different levels. Tritiated water was continuously injected in the upper ring, to investigate the presence of leaks in the plates fed by that distribution ring. During and after injection, water samples were periodically collected at the top of the blast furnace by condensing moisture from exit gases. The tritium activity, when present in the samples, indicates the existence of leaks in the cooling plates and, in some cases, allows to estimate the total water flow rate entering the blast furnace. Actual applications of this techniques are described. (Author).

45163 **(LBL—19858) Energy-efficient H.I.D. solid-state ballast. Phase I. Final report.** (Lawrence Berkeley Lab., CA (USA)). Nov 1980. Contract AC03-76SF00098. 85p. (EEB-L—81-04). NTIS, PC A05/MF A01; GPO Dep. File Number DE85016641.

The average efficiency of the six prototype ballasts when operated with G.E. and Sylvania lamps is 84.8%. The average efficiency of conventional high reactance autotransformer core/coil ballasts is 80%. With plus or minus 10% rated input voltage the ballast output power varied from -11.9% to +0.7%. Standard

core/coil ballasts have a +-11% regulation with a +-5% rated input voltage. Power factor increases from 85% at 60 Hz to 100% at approximately 15,000 Hz. However, resonant frequencies occur above 1000 Hz which will cause destruction of the lamp. For safe operation, ballast output frequencies below 1000 Hz are recommended. The standard core/coil ballast operates at 90% power factor. Analysis of the Phase I data and circuit design indicates that additional efficiency can be obtained through improved circuit design, i.e., eliminating inherent internal losses by improved component selection, redesigning portions of the circuit, and selection of the frequency for optimum efficiency and power factor.

45164 **(PB—85-201200/XAB) Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 3. Physical science studies.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Dec 1979. 751p. NTIS, PC A99/MF E04.

See also PB82-190422; Sponsored by Minerals Management Service, Anchorage, AK. Alaska Outer Continental Shelf Office.

A compilation of 7 final reports on the following subjects: oil spill vulnerability of the Kodiak Archipelago, dynamics of nearshore ice, sedimentology, geochemistry, and faulting of the St. George Basin, climatic effects on fast ice along the Beaufort Chukchi coasts, morphology of nearshore ice conditions, coastal morphology of the Bering Sea coast, oil spill trajectory analysis for the lower Cook Inlet, Alaska.

45165 **(UCRL—15704-Vol.1) Development of a simple oceanic mixed-layer and sea-ice model for use with an atmospheric GCM. Volume 1.** Pollard, D.; Batteen, M.L.; Han, Y.J. (Oregon State Univ., Corvallis (USA)). Dec 1980. Contract W-7405-ENG-48. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017264.

Climatic Research Institute Report No. 21.

A simple numerical model of the oceanic mixed layer and sea ice is described which is suitable for coupling to an atmospheric GCM. Earlier models of the mixed layers and sea ice as separate components are combined with little modification. Sea-ice thickness is determined thermodynamically by local melting or accretion, and the effects of ice transport and leads are neglected. Three model versions for the mixed layer are considered, ranging from a water slab of fixed thickness to a variable-depth mixed layer above the variable exponential temperature profile representing the seasonal thermocline. The model is tested by integrating to equilibrium in a zonally symmetric mode, using monthly climatological atmospheric data for a seleted north-south section in the mid-Pacific ocean, and the results for different model versions are compared with each other and with available observations. It is found that the fixed-slab version gives realistic sea-ice thickness and extent, and temperatures within ~1 to 2°C of observed sea-surface temperatures over much of the mid-Pacific. However, a variable-depth mixed layer is required to maintain this level of accuracy for summer sea-surface temperatures north of 40°N, and also to produce the correct phases of the annual cycles of temperature at all extratropical latitudes. Mixed-layer depths in the latter version are somewhat too shallow in winter, but overall seasonal pattern agrees with that observed. It is found that the addition of north-south advection by mixed-layer currents can give a reasonable simulation of equatorial upwelling. The use of different model versions results in different amounts of net annual vertical heat exchange with the deep ocean, which may be a significant effect for some climatic experiments with a coupled atmospheric GCM. 53 refs., 10 figs.

45166 **(UCRL—15704-Vol.2) Performance of an upper-ocean model coupled to an atmospheric GCM: preliminary results. Vol. 2.** Pollard, D. (Oregon State Univ., Corvallis (USA)). Feb 1982. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017265.

A global dynamical model of the upper ocean and sea ice is coupled to the OSU atmospheric general circulation model. Preliminary results are described from a 16-month simulation with seasonally-varying insolation, and compared with both observations and the results from two earlier experiments with simpler upper-ocean models. The present ocean model consists of two vertically homogeneous layers of variable thickness: the upper layer represents the well-mixed layer and can entrain or detrain fluid locally with the lower layer, as in standard mixed-layer models. The second layer typically has thicknesses of ~100 to ~400 meters and crudely represents the seasonal thermocline and the part of the main thermocline involved in the subtropical gyres; it rests immiscibly on deep water of no motion where the density contrast is prescribed. Horizontal advection is predicted in both layers by the primitive momentum equations. Sea ice can form if the upper-layer temperature (SST) drops to freezing, after which the local ice thickness is predicted thermo-dynamically with ice dynamics neglected. The 16-month simulation is started from relatively realistic conditions obtained by spinning up the atmospheric and oceanic models separately. After several months of the coupled run, errors of up to 4°C in the SST appear in the western oceans, probably due to the underestimate of the western boundary currents inherent in coarse-grid oceanic models. Equatorial upwelling and undercurrents are simulated but extend basin-wide, producing SSTs up to 6°C too cold in the western equatorial Pacific. The large-scale seasonal variation of sea-ice thickness and extent are fairly realistic. Surface heat fluxes are compared with observations and with an earlier control integration of the atmospheric GCM, in an effort to distinguish between errors in the SST caused by the upper-ocean model and those caused by the atmospheric model. 38 refs., 11 figs.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 43666, 43677, 44793, 45094, 45136, 45185

45167 **(CONF-850637—1) Significance of the distribution of bomb-produced radiocarbon in the ocean.** Peng, T.H. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016154.

From 12. international radiocarbon conference; Trondheim, Norway (24 Jun 1985).

The pattern of global water column inventories of bomb-produced radiocarbon suggests that a sizable portion of the bomb radiocarbon that entered the Antarctic, the northern Pacific, and the tropical oceans has been transported to the adjacent temperate regions. Models of lateral transport of surface water in the Atlantic, Indian, and Pacific Oceans are designed on the basis of this distribution pattern. Upwelling of bomb-radiocarbon-free water from below takes place in the Antarctic, the northern Pacific, and the tropical regions; and downwelling of surface water occurs in the temperate oceans and in the northern Atlantic. Uptake of excess CO_2 by these models is calculated using the observed Mauna Loa pCO_2 record as an input function. Results indicate that 35 percent of fossil fuel CO_2 is taken up by these model oceans during the period 1958-1980. Considering the observed airborne fraction of 0.55, it appears that about 10 percent of the global fossil fuel CO_2 is still missing. 24 refs., 5 tabs.

45168 **(CONF-850690—1) Pilot-scale development of anaerobic filter technology for municipal wastewater treatment.** Genung, R.K.; Donaldson, T.L.; Reed, G.D. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Civil Engineering). 1985. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016965.

From Anaerobic treatment of sewage: seminar and workshop; Amherst, MA, USA (27 Jun 1985).

The use of anaerobic filter technology for the treatment of low-strength municipal wastewater was studied by Oak Ridge National Laboratory (ORNL) in Knoxville, Tennessee, with a pilot-scale (e.g., 190-m^3/d) facility from August 1981 to October 1983. The Knoxville project (described by the acronym ANFLOW for the anaerobic, upflow characteristics of the technology) was a ten-fold scale-up of a previous ORNL study in Oak Ridge, Tennessee. Pollutant loading rates used in this study ranged from 0.1 to 0.7 kg/m^3 x d for total suspended solids (TSS) and from 0.1 to 0.4 kg/m^3 x d for biochemical oxygen demand (BOD); the hydraulic retention time ranged from 9 to 10 h. Removal efficiencies for TSS and BOD were 80 and 70%, respectively. This performance was maintained in ambient cold-weather tests (water temperature, ~12°C), even though the rate of solids accumulation in the bioreactor was higher because of decreased biological activity, which normally converts

solids to off-gas. The solids inventory in the bioreactor appeared to be diminished during warmer weather. 26 refs., 16 figs., 3 tabs.

45169 **(CONF-850912—1) Supercomputers in subsurface transport research: HYDROGEOCHEM on the Hypercube computer.** Tripathi, V.S.; Yeh, G.T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016148.

From Hydrological applications of supercomputers - future directions; West Lafayette, IN, USA (10 Sep 1985).

Hydrologic, geochemical, and coupled hydrologic-geochemical models serve as tools for testing various hypotheses about the underlying processes at laboratory and field scales and for identifying questions which must be addressed for making fundamental advances. HYDROGEOCHEM has been developed by interfacing FEMA, a finite-element transport model, with MINEQL and CHEMEQUIL, which are chemical equilibrium models. The iterative-solution algorithm in FEMA provides significantly faster execution speeds and decreased storage requirements in comparison with direct solution methods, and CHEMEQUIL offers substantial reduction in CPU time and storage requirements over MINEQL and similar programs. Error-propagation schemes are being incorporated in the chemical module of HYDROGEOCHEM. 5 refs. (ACR)

45170 **(CONF-8506180—1) Approaches to modeling the fate and effects of toxicants in pelagic systems.** Breck, J.E.; Bartell, S.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 50p. NTIS, PC A03. File Number DE85017302.

From Workshop on persistent toxic substances and the health of aquatic communities; Minneaspolis, MN, USA (17 Jun 1985).

Models sharing a common bioenergetics framework have been used to address concerns about toxic chemicals and their effects on the health of aquatic communities. A basic bioenergetics formulation has been expanded to study the dynamics of contaminants in fish, to forecast the fate of polynuclear aromatic hydrocarbons (PAHs) in aquatic systems, to estimate the probable effects of PAHs on production in pelagic systems, and to characterize the interactions between the fates and effects of contaminants. The bioenergetics framework facilitates simulation of the influence of physiological processes on contaminant dynamics and simulation of the modifying effect of contaminants on metabolic processes and ecological interactions. It also permits specification of fates and effects dynamics in terms of parameters that can be experimentally evaluated. The models serve as sets of operational hypotheses about the environmental behavior of xenobiotics and can be used to explore and evaluate the utility of available information. For example, simulations using the Combined Fates and Effects Model suggest that the importance of biological processes in determining the fate of naphthalene in an aquatic system varies over an annual cycle and in relation to the dose to the system.

45171 **(DOE/ER—0230) Design of field-scale experiments for research on subsurface transport of organic chemicals. Summary report .** Zachara, J.M. (Pacific Northwest Labs., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 25p. (CONF-841244—Summ.). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015284.

From Design of field scale experiments: subsurface transport of organics; Princeton, NJ, USA (17 Dec 1984).

Subsurface Transport Program interactive seminar series.

The third ISIS seminar was held to discuss the design of field experiments for elucidating the subsurface movement of organic chemicals, liquids, and organometal complexes. The need for field studies and researchable issues that merit investigation at the field scale was discussed. There was general agreement that field research is needed because the natural subsurface environment exhibits properties and process interactions that cannot be investigated inclusively in the laboratory. Hydrogeologists concluded that questions of scale, scaling and heterogeneity of properties represent priority research issues that require field investigation and that could be performed independent of research on organic chemicals and mixtures. Biogeochemists stressed the need for continued laboratory research on basic processes, but emphasized that experiments on process interactions in the field and their control by complex in situ properties were of great immediate concern. There were divergent views on the best strategy for field research, approach to field studies/experiments, and their conceptual design. Disagreements over the merits of intermediate-scale facilities were not resolved. Two "strawman" field-scale experiments were presented for hydrologic and biogeochemical research. Both emphasized use of natural subsurface systems and received favorable review by seminar participants. The seminar concluded with concensus that the most effective overall approach for DOE/OHER field research may consist of a combination of intermediate-size experiments and field-size subsurface studies.

45172 **(GKSS—85/E/3) Balancing experiment 1982 (BILEX '82) on the Unter Elbe River.** Michaelis, W.; Knauth, H.D. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1985. 212p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751898.

With 110 figs., 13 tabs.

Temporal variabilities and spatial heterogeneities which are characteristic for tidal rivers considerably complicate the treatment of the both ecologically and economically important transport of suspended particulate matter and heavy metals. In 1982, a new concept to tackle this problem and the experimental and theoretical tools developed for its realization were, for the first time, tested in a concerted action. The instrumentation and the simulation models (current simulation model MOHNA, transport model FLUSS) applied have, in principle, proved a success. The experience gained during the campaign allows conclusions with regard to possible improvements to further increase the output. Extensive hydrographic, trace analytical and mathematical results are presented. They permit to judge the chance of success of future experiments of this kind and give hints how to proceed with further transport investigations under the complex conditions of a tidal river.

45173 **(PB—238355) Estimating nutrient loadings of lakes from non-point sources.** Uttormark, P.D.; Chapin, J.D.; Green, K.M. (Wisconsin Univ., Madison (USA). Water Resources Center). Aug 1974. 112p. (EPA—660/3-74-020). NTIS.

Data describing nutrient contributions from non-point sources were compiled from the literature, converted to kg/ha/yr, and tabulated in a format convenient for estimating nutrient loadings of lakes. Contributing areas are subdivided according to general use categories, including agricultural, urban, forested, and wetland. Data describing nutrient transport by groundwater seepage and bulk precipitation are given along with data for nutrient contributions from manure handling, septic tanks, and agricultural fertilizers. Nutrient content of urban runoff was the highest; forested areas were lowest. Nutrient export data for agricultural lands were tabulated as: seepage through vertical soil profile, overland runoff, and transport by streams draining agricultural watersheds. The latter group was judged to be most applicable for estimating nutrient loadings of lakes. Marshes appear to temporarily store phosphorus and nitrogen during the growing season and release them at a later time; net nutrient runoff is estimated to be near zero. Nutrient contributions to lakes from groundwater seepage require site-specific information for assessment. Phosphorus and nitrogen transport by groundwater can be significant. Atmospheric contributions of nitrogen are large in some areas. The technique of estimating nutrient loadings of lakes requires considerable judgment in selecting runoff coefficients; however, the approach provides insight into potential management options.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 43869, 43880, 43887, 43890, 43891, 43892, 44752, 44838, 45126, 45127, 45128, 45129, 45167, 45172

45174 (AECL—7691) Subsurface contaminant transport from the liquid disposal area, CRNL. Hydrogeology and tritium contamination near the chemical pit. Killey, R.W.D.; Munch, J.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1984. 116p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701946.

This report summarizes geologic, hydrogeologic and geochemical information obtained from a detailed study of the aquifer receiving contaminated waste-waters from the Chemical Pit. Geologically, the study area features wind-deposited sand overlying a continuous lacustrine clayey silt and a bouldery basal till. Medium to coarse sands locally found at the base of the sand sequence appear to represent stream channel deposits following a buried drainage course towards Perch Lake. These channel sands significantly influence groundwater flow; 3-dimensional models will be required to mathematically simulate the system. Based on the subsurface data, calculated groundwater residence times between the infiltration pit and points of discharge to surface into the East Swamp range from 4 to 22 months. The shortest observed residence time for a non-reactive radio-nuclide is 5 months. Tritium data confirm that contamination is confined to the sands, but show that within the sand aquifer there is considerable heterogeneity in the distribution and rates of groundwater flow. Samples of contaminated groundwaters collected during this study featured increased redox potentials, increased acidity, and minor increases in some major ions relative to local uncontaminated groundwater. Extensive oxidation of the sands in contaminated portions of the aquifer may reflect much greater chemical differences in plume groundwaters in the past.

45175 (CONF-850749—1) Radioactivity in the ocean: laws and biological effects. Hunsaker, C.T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016315.

From 4. symposium on coastal and ocean management; Baltimore, MD, USA (30 Jul 1985).

This paper summarizes the literature on US laws and international agreements, experimental and monitoring data, and ongoing studies to provide background information for environmental assessment and regulatory compliance activities for ocean dumping of low-level radioactive waste. The Marine Protection, Research, and Sanctuaries Act is the major US legislation governing ocean disposal of radioactive waste. The major international agreement on ocean dumping is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter. The United States ended its ocean dumping of radioactive wastes in 1970, but other countries have continued ocean dumping under international supervision in the northeast Atlantic. Monitoring of former US disposal sites has neither revealed significant effects on marine biota nor indicated a hazard to human health. Also, no effects on marine organisms have been found that could be attributed to routine discharges into the Irish Sea from the Windscale reprocessing plant. We must improve our ability to predict the oceanic carrying capacity and the fate and effects of ionizing radiation in the marine environment.

45176 (INFO—0105) Origin and subsurface migration of radionuclides from waste rock at an abandoned uranium mine near Bancroft, Ontario. Veska, E.; Cherry, J.A.; Sharma, H.D. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Oct 1983. 315p. NTIS (US Sales Only), PC A14/MF A01. File Number DE85701951.

Uranium-mine waste rock dump sites may require long-term surveillance because of the potential contamination of radionuclides from waste rock to the subsurface environment. In order to assess the conditions and controls on the migration in groundwater of waste-rock-derived contaminants, an area of old waste rock of a sand aquifer at the abandoned Greyhawk uranium mine near Bancroft, Ontario, was monitored. The waste rock has been abandoned for more than two decades. The results of a four-year hydrological and radiological investigation at the Greyhawk site indicated the presence of contaminant plumes of sup(238)U, sup(234)U, sup(226)Ra, sup(210)Pb, sup(230)Th, sup(232)Th, sulphate, bicarbonate and dissolved inorganic carbon in the sand aquifer originating from the waste rock. Laboratory-determined parameters were applied in two contaminant migration models for simulating the observed frontal positions of the waste-rock-derived radionuclides in the sand aquifer and also for predicting the spread of radionuclide contamination in the future. With the possible exception of sup(238)U, reasonable results were obtained for the simulations of the sup(226)Ra, sup(210)Pb and sup(230)Th mobilities in the sand aquifer.

45177 (NUCLEBRAS-CDTN—486) Evaluation of maximum radionuclide concentration from decay chains migration in aquifers. Aquino Branco, O.E. de. (Minas Gerais Univ., Belo Horizonte (Brazil). Curso de Pos-graduacao em Ciencias e Tecnicas Nucleares). 1983. 100p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781557.

The mathematical formulation of the mechanisms involved in the transport of contaminants in aquifers is presented. The methodology employed is described. A method of calculating the maximum concentration of radionuclides migrating in the underground water, and resulting from one decay chain, is then proposed. As an example, the methodology is applied to a waste basin, built to receive effluents from a hypothetical uranium ore mining and milling facility.

45178 (PER—87) Environmental radioactivity at the National Nuclear Research Centre, Pelindaba. Report for the year 1983. Brits, R.J.N.; Van der Westhuizen, G.S.H.; Annandale, J.; Moolman, E.W. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Dec 1984. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701964.

The revised environmental survey program, introduced during 1970 with the emphasis on monitoring of the critical paths of exposure of the general public, was continued in 1983. Results of determinations of both gross radioactivity and individual nuclides in samples of fish and water (which are critical materials for liquid-effluent releases) from the Hartbeespoort Dam and from the Crocodile River, are given and discussed. These results are given in SI-units for the first time. Results of ^{131}I, ^{90}Sr and gamma-spectrometric analyses of milk, the critical material for releases to the atmosphere, are presented. Results are given of regular investigations of the composition of airborne releases to the atmosphere and liquid-effluent releases to the Crocodile River, performed in order to detect other possible critical nuclides. Levels of deposited and airborne activity from nuclear-bomb tests are reported. Due to absence of fresh fallout material the levels for most fission products have fallen below the limit of detection. No environmental radioactivity due to releases from the Pelindaba site could be detected above the natural background or accumulated fallout levels. Unplanned releases of UF_6 occur sometimes. Accordingly, some of the environmental samples were also analysed for uranium. The results obtained so far do not indicate an increase in uranium levels in the environment.

45179 (SCPRI-RM—7-1984) Monthly results of measurements, July 1984. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Aug 1984. 33p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751206.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--3-1984 report).

45180 (UCRL—53628) Radionuclide Migation Project 1984 progress report. Buddemeier, R.W.; Isherwood, D. (comps.). (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017383.

The report discusses the hydrogeologic settings and histories of studies associated with the Cheshire (U20n), Cambric (U5e),

Nash (UE2ce), Bilby (U3cn), Bourbon (U7n), and Faultless (UC1) Events. Radionuclide and some chemical data are presented for water samples from cavity or chimney wells associated with the Cheshire, Cambric, and Bilby Events, and from satellite wells at the Cambric, Nash, Bibly, Bourbon, and Faultless Event sites. The report also gives the results of studies of specific sampling or analytical methodologies. These studies demonstrated that the apparent migration of ^{155}Eu is an artfact of spectrometric misidentification of gamma- and x-ray peaks from other constituents. A potential problem with atmospheric contamination of samples collected with evacuated thief samples was also identified. Ultrafiltration techniques were applied to some of the Cheshire cavity samples collected, and preliminary results suggest that substantial amounts of activity may be associated with colloidal particles in the size range of 0.006 to 0.45 μm. A study has begun of the recharge of effluent water from RNM-2S (Cambric satellite well) into the desert floor as a result of nine years of continuous pumping. This report gives the initial results of unsaturated zone studies showing the propagation of moisture and tritium fronts through the shallow soil. Geochemical modeling of the behavior of ruthenium and technetium was carried out, with particular emphasis on the identification of ionic species that would be potentially mobile under NTS groundwater conditions. The report compares the results with observations of ruthenium migration to the Cambric satellite well.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 45192

45181 (DP-MS—85-68) Remote sensing inland wetlands: a multispectral approach. Jensen, J.R.; Hodgson, M.E.; Christensen, E.; Mackey, H.E. Jr.; Tinney, L.R.; Sharitz, R. (South Carolina Univ., Columbia (USA). Dept. of Geography; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group; Savannah River Ecology Lab., Aiken, SC (USA)). 1985. Contract AC09-76SR00001. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017060.

Airborne Multispectral Scanner (MSS) data, large-scale aerial photography, and LANDSAT MSS and Thematic Mapper (TM) data were used to map a variety of wetland conditions along the Savannah River watershed in South Carolina. Predawn thermal infrared MSS imagery was analyzed to map the spatial distribution and migration of thermal effluent entering a portion of the Savannah River floodplain and the Savannah River below Augusta, Georgia. Daytime airborne MSS data were used to classify specific wetland vegetation types and associate them with their apparent (remotely sensed) temperature. Large scale, multiple data aerial photography were ideally suited to follow the growth of vegetational changes associated with the thermal discharges into the floodplain. LANDSAT MSS imagery obtained in the spring was used effectively to map the entire Savannah River watershed. LANDSAT TM imagery obtained in the summer was of limited use in regional wetland mapping. 21 refs., 11 figs., 3 tabs.

45182 (DPST—85-218) Lower food chain community study: thermal effects and post-thermal recovery in the streams and swamps of the Savannah River Plant, November 1983-May 1984. Kondratieff, B.C.; Kondratieff, P. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Apr 1985. Contract AC09-76SR00001. 159p. (ECS-SR—15). NTIS, PC A08/MF A01; GPO Dep. File Number DE85017043.

This report documents a study of lower food chain (autotroph and macroinvertebrate assemblage) response to, and recovery from, thermal stress in the streams and swamps of the Savannah River Plant (SRP). Data for the report were collected between November 1983 and May 1984. Elevated water temperature regimes in the thermal streams and swamps resulted in generally simplified lower food chain community structure. Thermally tolerant forms of both autotrophs (blue-green algae) and macroinvertebrates (oligochaetes, nematodes, snails and midges) were able to maintain populations in thermally stressed areas. The thermally tolerant taxa found in the perturbed streams and swamps often had high densities and biomass. It would appear tht many of the macroinvertebrate species occurring in SRP streams and swamps evolved in habitats subject to great thermal variation, both diel and seasonal. Based on the results of this study, certain temperature ranges are associated with certain general effects on the lower food chain. In temperatures >40°C most taxa are eliminated, from 30 to 40°C a stressed community exists with a few tolerant taxa and from 25 to 30°C an assemblage resembling a summer ambient community in structure and function exists, often with reduced species composition. 74 refs., 20 figs., 18 tabs. (ACR)

45183 (DPST—85-375) Savannah River Aquatic Ecology Program. Volume I. Adult fish. Annual report, November 1983-August 1984. Paller, M.; Osteen, D.V. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). May 1985. Contract AC09-76SR00001. 142p. (ECS-SR—17). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017042.

A multipurpose study on the fish community of the Savannah River near the Savannah River Plant was conducted between September 1983 and August 1984. The major portion of this study examined the abundance and distribution of fishes near the Savannah River Plant in relation to the thermal discharges into the river, creeks and the floodplain swamp. Another portion of the study examined the rates of impingement of juvenile and adult fishes onto the river water intake screens in order to assess the potential influence of this plant operation on the fish community. 24 refs., 13 figs., 23 tabs.

45184 (EGG/10282—1057, pp 19.1-19.16) Remote sensing analysis of thermal plumes at the Savannah River Plant. Doak, E.L. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The nuclear reactors of the Savannah River Plant (SRP) in Aiken, South Carolina, use cold water diverted from the Savannah River to dissipate unused thermal energy. This water is heated by heat exchangers of the reactors during the materials production process, and then returned to the natural drainage system. Thermal effluents were monitored by an airborne thermal infrared scanner during predawn overlights. Images were generated to show the surface temperature distribution of the thermal outfall plumes into the Savannah River. The thermal analysis provides information related to compliance with permit requirements of the regulatory agencies.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 45091, 45264

45185 (ANL/ER—85-2) State of the Middle Great Lakes: results of the 1983 water quality survey of Lakes Erie, Huron, and Michigan. Lesht, B.M.; Rockwell, D.C. (Argonne National Lab., IL (USA)). Aug 1985. Contract W-31-109-ENG-38. 181p. NTIS, PC E08/MF A01; 1; GPO Dep. File Number DE85017140.

Results and program objewaatertives are discussed in the context of past and proposed lake surveillance activities. Surveillance methods are briefly explained. Data are evaluated and compared relative to spatial, temporal and seasonal variability within and between the three lakes sampled and in relation to water-quality assessment issues. Survey results and historical data on water-quality parameters are compared with the results of numerical simulations using two different types of model - nutrient-based eutrophication models and multisegment, mass-balance models. The authors conclude, on the basis of the 1983 surveillance program results, that water-quality conditions of the three lakes have, in general, improved since the last intensive survey in the 1970s. Recommendations are made that open-lake water-quality surveillance be conducted on an annual basis; that estimates of nutrient loading to the lakes be refined; that the role of the benthic nepheloid layer and of particle removal in general on the cycling of nutrients in the Great Lakes be studied; that refinement of water-quality modeling efforts be continued; and that research activities and methodology be incorporated into the surveillance program. Finally, raw data collected during the 1983 program are presented in tabular form

and on microfiche in appendices at the end of the report. Cruise data are included on microfiche. 53 refs., 54 figs., 43 tabs.

45186 **(DOE/BP—313) Wildlife impact assessment and mitigation summary: Montana Hydroelectric Projects. Volume III. Hungry Horse Dam. Final report.** (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Oct 1984. Contract AI79-83BP11983. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016232.

This assessment addresses the impacts to the wildlife populations and wildlife habitats due to the Hungry Horse Dam project on the South Fork of the Flathead River and previous mitigation of theses losses. In order to develop and focus mitigation efforts, it was first necessary to estimate wildlife and wildlife hatitat losses attributable to the construction and operation of the project. The purpose of this report was to document the best available information concerning the degree of impacts to target wildlife species. Indirect benefits to wildlife species not listed will be identified during the development of alternative mitigation measures. Wildlife species incurring positive impacts attributable to the project were identified.

45187 **(DOE/BP—315) Wildlife impact assessment and summary of previous mitigation related to hydroelectric projects in Montana. Phase 1. Volume Two(b). Clark Fork River Projects: Cabinet Gorge and Noxon Rapids Dams. Final report.** Wood, M.; Olsen, A. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)). Jun 1984. Contract AI79-83BP11983. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016335.

This report documents best available information concerning the wildlife species impacted and the degree of the impact. A target species list was developed to focus the impact assessment and to direct mitigation efforts. Many non-target species also incurred impacts but are not discussed in this report. All wildlife habitats inundated by the two reservoirs are represented by the target species. It was assumed the numerous non-target species also affected will be benefited by the mitigation measures adopted for the target species. Impacts addressed are limited to those directly attributable to the loss of habitat and displacement of wildlife populations due to the construction and operation of the two hydroelectric projects. Secondary impacts, such as the relocation of railroads and highways, and the increase of the human population, were not considered. In some cases, both positive and negative impacts were assessed; and the overall net effect was reported. The loss/gain estimates reported represent impacts considered to have occurred during one point in time except where otherwise noted. When possible, quantitative estimates were developed based on historical information from the area or on data from similar areas. Qualitative loss estimates of low, moderate, or high with supporting rationale were assessed for each species or species group.

45188 **(DOE/BP—421) Annual review of BPA-funded projects in natural and artificial propagation of salmonids.** (USDOE Bonneville Power Administration, Portland, OR). Apr 1985. 72p. (CONF-8503161—Absts.). NTIS, PC A04/MF A01; GPO Dep. File Number DE85015782.

From Annual review of BPA-funded projects in natural and artificial propagation of salmonids; Portland, OR, USA (27 Mar 1985).

The Fish and Wildlife Division of Bonneville Power Administration (BPA) hosted a meeting for contractors to present the results of fiscal year 1984 research conducted to implement the Northwest Power Planning Council's Fish and Wildlife Program. The meeting focused on those projects specifically related to natural and artificial propagation of salmonids. The presentations were held at the Holiday Inn Airport in Portland, Oregon, on March 27-29, 1985. This document contains abstracts of the presentations from that meeting. Section 1 contains abstracts on artificial propagation, fish health, and downstream migration, and Section 2 contains abstracts on natural propagation and habitat improvement. The abstracts are indexed by BPA Project Number and by Fish and Wildlife Program Measure. The registered attendees at the meeting are listed alphabetically in Appendix A and by affiliation in Appendix B.

45189 **(DOE/BP—39461-1) Yakima River Spring Chinook Enhancement Study. Annual report, FY 1984.** Wasserman, L.; Hubble, J.; Watson, B. (Yakima Indian Nation, WA (USA). Fisheries Resource Management). Jan 1985. Contract AI79-83BP39461. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85016269.

This study develops data to present management alternatives for Yakima River spring chinook. The first objective is to determine the distribution, abundance and survival of wild Yakima River spring chinook. Naturally produced populations will be studied to determine if these runs can be sustained in the face of present harvest and environmental conditions. This information will be gathered through spawning ground surveys, counting of adults at Prosser and Roza fish ladders, and through monitoring the tribal dipnet fishery. Concurrent studies will examine potential habitat limitations within the basin. Presently, survival to emergence studies, in conjunction with substrate quality analysis is being undertaken. Water temperature is monitored throughout the basin, and seining takes place monthly to evaluate distribution and abundance. The outcome of this phase of the investigation is to determine an effective manner for introducing hatchery stocks that minimize the impacts on the wild population. The second objective of this study is to determine relative effectiveness of different methods of hatchery supplementation.

45190 **(DOE/BP/17463—T1) Fish passage improvements at Three Mile Falls Diversion Dam, Umatilla River, Oregon. Final completion report.** (Bureau of Reclamation, Boise, ID (USA). Pacific Northwest Region). May 1985. Contract AI79-83BP17463. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016095.

This report contains the results and conclusions from the biological assessment and outlines several alternative plans for solving fish passage problems at the dam. A recommended plan, based on consensus of the fisheries agencies and the tribes, is described, and the rationale for that decision is discussed. Data needs for final designs, a tentative construction schedule, and a discussion of operation and maintenance needs are presented.

45191 **(DOE/BP/36717—1) Cumulative effects of microhydro development on the fisheries of the Swan River Drainage, Montana. Volume I. Summary report. Final report.** Leathe, S.A.; Enk, M.D. (Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA). Fisheries Research and Special Projects Bureau; Forest Service, Bigfork, MT (USA). Flathead National Forest). Jul 1985. Contract AI79-82BP36717;AI79-83BP39802. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85016242.

This study was designed to develop and apply methods to evaluate the cumulative effects of 20 proposed small hydro projects on the fisheries resources of the Swan River drainage located in northwestern Montana. Fish population and reach classification information was used to estimate total populations of 107,000 brook trout, 65,000 cut-throat trout and 31,000 juvenile bull trout within the tributary system. Distribution, abundance, and life history of fish species in the drainage and their contribution to the sport fishery were considered in the cumulative impact analysis. Bull trout were chosen as the primary species of concern because of their extensive use of project areas, sensitivity to streambed sedimentation, and their importance to the lake and river sport fisheries. Dewatering of hydroelectric diversion zones and streambed sedimentation (resulting from forest and small hydro development) were the major impacts considered. The developer proposed to divert up to the entire streamflow during low flow months because maintenance of recommended minimum bypass flows would not allow profitable project operation. Dewatering was assumed to result in a total loss of fish production in these areas. 105 refs., 19 figs., 38 tabs.

45192 **(DPST—84-851-Vol.2) Savannah River aquatic ecology program. Annual report, September 1982-August 1983. Volume II.** Specht, W.; Kania, H.J.; Painter, W. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Apr 1985. Contract AC09-76SR00001. 159p. (ECS-SR—9-Vol.2). NTIS, PC A08/MF A01; GPO Dep. File Number DE85017334.

This report presents the results of macroinvertebrate colonization on Hester Dendy artificial substrate samplers, macroinvertebrate drift studies, periphyton studies, and water quality analyses conducted from September 1982 through August 1983. The objectives were to: (1) determine the taxonomic composition, biomass and density of macroinvertebrates in the Savannah River and tributary creeks in the vicinity of the SRP; (2) determine the taxonomic composition and densities of macroinvertebrates inthe drift communities of the Savannah River and five tributary creeks in the vicinity of the SRP; (3) determine the biomass and chlorophyll a content of periphyton communities in the Savannah River and tributary creeks in the vicinity of the SRP; (4) evaluate water quality data for selected parameters in the Savannah River and major tributary creeks upstream, downstream and in the vicinity of the SRP; and (5) evaluate the possible impacts of the existing and proposed SRP thermal discharges to the periphyton and macroinvertebrate communities of the Savannah River and tributary creeks. 3 figs., 23 tabs.

5206 Regulations

REFER ALSO TO CITATION(S) 43663, 45175

53 Social And Economic Studies

REFER ALSO TO CITATION(S) 43733

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 44460

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 43669, 44173

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 43675, 44004, 44005, 45263

45193 **(CONF-850871—7) Small-angle neutron scattering studies from solutions of bovine nasal cartilage proteoglycan.** Patel, A.; Stivala, S.S.; Damle, S.P.; Gregory, J.D.; Bunick, G.J.; Uberbacher, E.C. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Chemistry and Chemical Engineering; Rockefeller Univ., New York (USA); Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016935.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

Small-angle neutron scattering, SANS, of the proteoglycan subunit of bovine nasal cartilage in 0.15N LiCl at 25°C yielded the radius of gyration, R/sub g/, radius of gyration of the cross-section, R/sub q/, persistence length, a, and the molecular weight, M. The following values were obtained: M = 3.9 x 10^6, R/sub g/ = 745 A, R/sub q/ = 34.6 A and a = 35.2 A. These values compare favorably with those that were obtained from small angle x-ray scattering, SAXS, of a similar extract. The scattering curve of the proteoglycan subunit in D_2O showed a characteristic broad peak in the specified angular range similar to that observed from SAXS, thus confirming the polyelectrolyte nature of the proteoglycan. 15 refs., 3 figs., 1 tab. (DT)

45194 **Characterization of two crystal forms of neutrophil cationic protein NP2, a naturally occurring broad-spectrum antimicrobial agent from leukocytes.** Westbrook, E.M.; Lehrer, R.I.; Selsted, M.E. (Argonne National Lab., IL). *Journal of Molecular Biology;* **178**: 783-785(1984). Contract W-31-109-ENG-38.

A hexagonal crystal form ($P6_522$, a = b = 34.0 A, c = 113.5 A) and a monoclinic form ($P2_1$, a = 37.1 A, b = 32.2 A, c = 32.4 A, β = 110°) of neutrophil cationic protein NP2, isolated from rabbit leukocytes, have been characterized. The monoclinic form, containing two promoters (M/sub r/ = 3844) per asymmetric unit, diffracts to at least 1.8 A and is suitable for high-resolution structural studies. 10 references.

45195 **Differential toxicity of 3-aminobenzamide to wild-type and 6-thioguanine-resistant Chinese hamster cells by interference with pathways of purine biosynthesis.** Cleaver, J.E. (Univ. of California, San Francisco). *Mutation Research;* **131**: 123-127(1984). Contract AC03-76SF01012.

3-Aminobenzamide is commonly assumed to be a specific inhibitor of poly(ADP-ribose) polymerase. However, it also inhibits de novo synthesis of DNA purines at concentrations of 5 mM and above. A mutant cell line that lacks the ability to incorporate exogenous purines is therefore exceptionally sensitive to the toxic effects of 3-aminobenzamide. This finding has implications for the underlying mechanism of sensitivity to 3-aminobenzamide recently reported in a cell line from an immunodeficient patient, and also implies that many studies using high concentrations of 3-aminobenzamide may not demonstrate a role for poly(ADP-ribose) because of artifacts arising from disturbance of intracellular purine metabolism. 20 references, 2 figures, 2 tables.

5503 Cytology

REFER ALSO TO CITATION(S) 43738

45196 **(LA-UR—85-990) Formation of microvilli.** Oster, G.F.; Murray, J.D.; Odell, G.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-8503160—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85009637.

From UCLA symposium on animal forms; Salt Lake City, UT, USA (30 Mar 1985).

Microvilli on cells frequently display a regular hexagonal packing pattern. We present here a model for how this regular pattern is established and how the microvilli are extruded from the cell. The model is based on the viscoelastic properties of the actomyosin gel in the cell cortex. 16 refs., 7 figs.

45197 **(UCRL—92836) Variation in baseline sister chromatid exchange frequencies in humans.** Carrano, A.V.; Ashworth, L.K.; Minkler, J.L.; Moore, D.H. II. (Lawrence Livermore National Lab., CA (USA)). 18 Jun 1985. Contract W-7405-ENG-48. 7p. (CONF-8506137—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016084.

From 4. international conference on environmental mutagens; Stockholm, Sweden (24 Jun 1985).

The lymphocyte is a surrogate cell that is routinely used to measure sister chromatid exchange (SCE) frequencies in humans. Our interests have focused on identifying sources of variability in human lymphocyte SCE frequencies, quantifying the magnitude of the variation, and understanding how it might affect the interpretation of data from mutagen-exposed groups. We have measured lymphocyte SCE frequencies in more than 900 blood samples from over 500 individuals. 5 refs., 3 figs., 2 tabs.

45198 **DNA-based human karyotype.** Mayall, B.H.; Carrano, A.V.; Moore, C.H. II; Ashworth, L.K.; Bennett, D.E.; Mendelsohn, M.L. (Univ. of California, Livermore). *Cytometry (Baltimore);* **5**: 376-385(1984). Contract W-7405-ENG-48.

Image cytometry and computer analysis are used to determine the relative DNA content and the DNA-based centromeric index of the 24 chromosomes of the human karyotype. A two-step procedure is used. Chromosomes of cells in metaphase first are stained with quinacrine and identified visually by their fluorescent Q-band patterns. They then are stained for DNA using gallocyanin-chrome alum. The chromosome images are scanned and recorded as digital values of optical density by an CYDAC image cytometric microscope system, CYDAC. The digital images are processed by computer to measure for each chromosome the relative DNA stain

contents of the whole chromosome and of the p and q arms and the DNA-based centromeric index. About ten cells are analyzed for each of the donors, who are phenotypically normal men and women. The chromosome measurements are pooled by chromosome type for each donor and are compared among donors. The means of the chromosome measurements give the DNA-based human karyotype. Analysis of the DNA-based data shows that some chromosomes or portions of chromosomes vary significantly among donors. These variants do not correlate with detectable morphologic polymorphisms, such as Q- or C-band variants; thus they represent new and otherwise undetectable chromosome polymorphisms whose genetic basis and clinical significance are yet to be determined. 54 references, 1 figure, 3 tables.

5504 Genetics

REFER ALSO TO CITATION(S) 45197, 45214

5505 Metabolism

REFER ALSO TO CITATION(S) 45265

45199 **(LA—10442-MS) Melphalan metabolism in cultured cells.** Seagrave, J.C.; Valdez, J.G.; Tobey, R.A.; Gurley, L.R. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016218.

Procedures are presented for the adaptation of reversed-phase-HPLC methods to accomplish separation and isolation of the cancer therapeutic drug melphalan (L-phenylalanine mustard) and its metabolic products from whole cells. Five major degradation products of melphalan were observed following its hydrolysis in phosphate buffer in vitro. The two most polar of these products (or modifications of them) were also found in the cytosol of Chinese hamster CHO cells. The amounts of these two polar products (shown not to be mono- or dihydroxymelphalan) were significantly changed by the pretreatment of cells with $ZnCl_2$, one being increased in amount while the other was reduced to an insignificant level. In $ZnCl_2$-treated cells, there was also an increased binding of melphalan (or its derivatives) to one protein fraction resolved by gel filtration-HPLC. These observations suggest that changes in polar melphalan products, and perhaps their interaction with a protein, may by involved in the reduction of melphalan cytotoxicity observed in $ZnCl_2$-treated cells. While $ZnCl_2$ is also known to increase the level of glutathione in cells, no significant amounts of glutathione-melphalan derivatives of the type formed non-enzymatically in vitro could be detected in $ZnCl_2$-treated or untreated cells. Formation of derivatives of melphalan with glutathione catabolic products in $ZnCl_2$-treated cells has not yet been eliminated, however. 17 refs., 5 figs., 1 tab.

5506 Medicine

REFER ALSO TO CITATION(S) 44792, 44983, 44986, 45016, 45230, 45252, 45738

45200 **(CEA-CONF—7629) Cerebral haemodynamic and metabolic changes in carotid artery occlusion: a PET study.** Samson, Y.; Loc'h, C.; Ottaviani, M.; Baron, J.C.; Bousser, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 7p. (CONF-8409242—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752076.

From International conference on cerebro-vascular disease; Salzburg, Austria (24 Sep 1984).

Using the positron emission tomography, with the O^{15} inhalation technique, the cerebral blood flow (CBF), the oxygen extraction fraction (OEF) and the cerebral metabolic rate of oxygen ($CMRO_2$) were studied in 37 patients with internal carotid artery (ICA) occlusion. In the territory of the occluded ICA, two pattern of focal anomaly have been observed: a CBF decrease with a "compensatory" OEF increase or a matched CBF and $CMRO_2$ decrease. On the other hand, as compared to age matched control values, $CMRO_2$ is significantly decreased in the territory of the occluded carotid only in patients with extensive neck vessels obstructive disease.

45201 **(FRNC-TH—1821) Study of paramagnetic contrast agents for NMR imaging: theoretical and experimental aspects (the case of Mn^{2+} ion).** Chavoix, M.E. (Toulouse-3 Univ., 31 (France)). Jun 1984. 150p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751174.

The use of contrast enhancing agents and the evaluation of magnetic properties of tissues, extend the diagnostic usefulness of Nuclear Magnetic Resonance (NMR) imaging. From this point of view, proton T_1 (spin-lattice) relaxation times of rat tissue, following parenteral administration of Mn(II) to increase the relaxation rate ($R_1 = 1/T_1$), have been studied at 20 MHz. Differenciation of free (MF) and bound (Mb) manganese in these tissues was thus determined by measuring, total exogenous Mn^{++} ions by Atomic Absorption spectrometry and free (non protein complexed) ions by Electron Spin Resonance Analysis. From these results, the diffusion of Mn^{++} into various organs, was evaluated 15 min. after injection. A significant difference in the fixation of manganese occured between the liver and the pancreas with uptakes of 50% and 1% of the administration dose respectively.

45202 **(GSF-S—1037) Field study to evaluate radiation doses in dental practices.** Panzer, W.; Scheurer, C. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). May 1984. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751880.

An inexpensive and simple test device was developed and used in a field study to evaluate entrance dose, dose to an intra-oral film, filtration and field size under routine conditions in more than 150 dental practices. The test device consists of two films of different speed and a set of 5 thin copper filters for a filter analytical determination of the radiation quality. Dentists voluntarily participating in the study were asked to expose the test device like they usually do when examining a molar tooth. The main result was the evidence of a significant dose reduction compared to the findings of similar studies performed in 1970 and 1976. This reduction is due to a general shift to lower values and a complete disappearance of values above 45 mGy (5 R) which in 1970 were still more than 15%. In the same way the number of facilities showing insufficient filtration or collimation had decreased. Nevertheless, a large spread of dose values could still be observed, ranging from less than 0.45 mGy (50 mR) to more than 26 mGy (3 R), for the entrance dose. The most striking result, however, was that such an important parameter like the speed of the films used at the respective unit turned out to have no impact on the entrance dose.

45203 **Failla Memorial Lecture: the future of heavy-ion science in biology and medicine.** Tobias, C.A. (Univ. of California, Berkeley). *Radiation Research;* **103**: No. 1, 1-33(Jul 1985). (CONF-860423—). Contract AC03-76SF00098.

From Radiation Research Society annual meeting; Las Vegas, NV, USA (13 Apr 1986).

An extensive review, with over 100 references, of the use of accelerator techniques in radiobiology is presented. Currently, beams of any stable isotope species up to uranium are available at kinetic energies of several hundred MeV/nucleon at the Berkeley Bevalac. The heavy ions hold interest for a broad spectrum of research because of their effectiveness in producing a series of major lesions in DNA along single particle tracks and because of the Bragg depth ionization properties that allow the precise deposition of highly localized doses deep in the human body. Heavy ions, when compared to low-LET radiation, have increased effectiveness for mammalian cell lethality, chromosome mutations, and cell transformation. The molecular mechanisms are not completely understood but appear to involve fragmentation and reintegration of DNA. Heavy ions do not require the presence of oxygen for producing their effects. Heavy ions are effective in delaying or blocking the cell division process. These radiobiological properties, combined with the ability to deliver highly localized internal doses, make accelerated heavy ions potentially important radiotherapeutic tools. Other novel approaches include the utilization of radioactive heavy beams as instant tracers. Heavy-ion radiography and microscopy respond to delicate changes in tissue electron density. The au-

thors laboratory is in the process of proposing a research biomedical heavy-ion accelerator; the availability of such machines would greatly accelerate cancer and brain research with particle beams.

45204 **Dead time correction and counting statistics for positron tomography.** Mazoyer, B.M.; Roos, M.S.; Huesman, R.H. (California Univ., Berkeley (USA). Donner Lab.; Lawrence Berkeley Lab., CA (USA)). *Physics in Medicine and Biology;* **30**: No. 5, 385-399(May 1985).

A correction for loss of events due to dead time in dynamic positron emission tomography (PET) is presented. The model employs a paralysing dead time to describe the behaviour of a tomograph over the range of event rates normally encountered in patient studies (up to 200 000 events/s per detector layer). The Donner 280-crystal positron tomograph has a dead time of 1.8 μs/event for observed count rates less than 200 000 events/s. The dead time correction factor is 1.8 at 180 000 events/s. The correction is applied to projection data and region of interest analysis of dynamic PET studies, and formulae for the covariances between corrected projection data and between counts in regions of interest in different images from the same dynamic study are established. At 180 000 events/s, the variance of the actual (corrected) number of events in a region containing 3.34×10^5 actual events is predicted from the model to be 3.86×10^6 (events)^2, more than 10 times the variance that would be expected from a naive assumption of Poisson statistics. These statistical results are verified experimentally. An error of 25% is observed in myocardial flow if dead time compensation is not applied, showing the necessity for this correction.

45205 **Lung clearance of inhaled /sup 99m/Tc-DTPA in the dog.** Oberdoerster, G.; Utell, M.J.; Weber, D.A.; Ivanovich, M.; Hyde, R.W.; Morrow, P.E. (Univ. of Rochester School of Medicine and Dentistry, NY). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology;* **57**: No. 2, 589-595(1984). Contract AC02-76EV03490.

A study was made of the reproducibility of measuring an index of permeability of respiratory epithelium in dogs using aerosolized /sup 99m/Tc-DTPA (diethylenetriaminepentaacetate). The method uses a gamma camera to measure the rate of clearance of soluble radioactive aerosol deposited in the lung. A solution of /sup 99m/Tc-DTPA in normal saline was aerosolized by an ultrasonic nebulizer. Eleven anesthetized dogs breathing spontaneously inhaled the resulting droplets for 2 min. Mass median aerodynamic diameter of the droplets was 4.4 μm with a geometric standard deviation of 2.1. Clearance from the lung was monitored by quantitative gamma camera imaging for up to 2 h. For a 60-min observation period, the biological half-life for clearance of /sup 99m/Tc-DTPA from both lungs was 66 +/- 11 (SD) min. Apical regions cleared significantly slower than basal regions, probably because of a larger portion of bronchial tissue in the apical region of the dog's lung. The best reproducibility of absorption of /sup 99m/Tc-DTPA in the dog was obtained from basal regions and peripheral zones of the lung within 30 min after inhalation of the radioaerosol.

45206 **In vivo binding of spiroperidol and bromospiroperidol at low drug loadings.** DeJesus, O.T.; Revenaugh, J.R.; Dinerstein, R.J.; Friedman, A.M. (Univ. of Chicago, IL). *Life Sciences;* **35**: 2165-2168(1984).

The binding of spiroperidol and bromospiroperidol, in vivo, was studied over a wide range of drug dosages. It was found that while spiroperidol and bromospiroperidol bind selectively in vivo to tissues known to be high in dopamine receptor binding sites, this specificity of binding does not persist at very low doses. Such anomalous binding behavior can have implications for the non-invasive imaging of these drugs. 13 references, 2 figures.

5507 Microbiology

45207 **(LA-UR—85-2368) Raman activity in synchronously dividing bacteria.** Layne, S.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-850784—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015672.

From Computer analysis for life science; Okayama, Japan (9 Jul 1985).

Using a spectrometer equipped with an optical-multichannel analyzer as the detector (OMA), we have observed the Stokes laser-Raman spectra of metabolically active Escherichia coli and Bacillus megaterium from 100 - 2100 cm^{-1}. After lengthy investigation, no Raman lines attributable to the metabolic process nor the cells themselves were found. Previous Raman spectra of active bacteria cannot be used to support nonlinear theories in biology. 34 refs., 9 figs.

5509 Pathology

REFER ALSO TO CITATION(S) 43738

5510 Physiological Systems

45208 **(FRNC-TH—1621) Use of tritium-labelled water in the study of transfers and exchanges in Helianthus annuus.** Puard, M. (Montpellier-2 Univ., 34 (France)). 16 Nov 1982. 95p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751205.

A labelling method with tritium-labelled water was developed and an experiment was carried out to study the kinetics of water transfer in the plant, to measure the extent of water vapour exchange between the leaves and atmosphere and the migration of this water towards the root systems.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 43962, 44016, 44558, 44559

45209 **(CONF-801197—) Farm Bureau energy idea symposium: proceedings.** Porterfield, J. (ed.). (American Farm Bureau Federation, Park Ridge, IL). 1980. 193p. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

The Farm Bureau awarded 10 members $500.00 each plus a trip to Chicago for the best ideas in energy savings and energy production for 1980. These projects plus 8 others were shared at the symposium and are included in this publication. Separate abstracts have been prepared for items within scope for inclusion in the Energy Data Base. (DMC)

45210 (CONF-801197—, pp 4-11) **Agriculture: opportunities and alternatives for the year 2000.** Jensen, M.H. (Univ. of Arizona, Tucson). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

How will agriculture systems look in the year 2000 - less than 20 years from now-with a world population 50% greater than the four billion of today. We will need to increase drastically the supply of food over the next two decades. Already this output has been boosted through the application of new farming techniques, but to meet the ever-increasing food needs of tomorrow, new measures must be presented offering alternatives in food production. It is the University of Arizona's Environmental Research Laboratory which has been selected by the Disney organization to assist in the design, construction and operation of a large agricultural exhibit called the "Land Pavilion". The spectator will see the most modern agricultural system in the world, whether it be in the tropics or desert. Highlighted are agricultural research and development programs for the food systems of tomorrow. Presented is a preview of how these agricultural systems might look in growing tomorrow's food today.

45211 (CONF-801197—, pp 12-28) **Aerated drip irrigation.** Anderson, W. (Bonniville County Farm Bureau, Idaho Falls, ID). 1980. American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068. File Number TI81903329.

From Farm bureau energy idea symposium; Des Plaines, IL, USA (18 Nov 1980).

Described is an aerated drip irrigation system to nearly double potato yields and hasten their maturity. The system saves 75% of energy costs and reduces water need for irrigation by 50%. A 50% plus reduction in fertilizer use is estimated since the water is applied at the root zone.

45212 **(Juel—1958) Uptake of and follow-up supply with [benzene ring-U-^{14}C]triademinol via the caryopsis and from dressed zones after seed treatment of winter barley and winter wheat using a dry dressing formula.** Thielert, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie; Bonn Univ. (Germany, F.R.)). Nov 1984. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752095.

The paper on hand studies the following issues: 1) What is the course of uptake of the agent and/or its metabolites into the plant following dry seed treatment of winter barley and winter wheat with [benzene ring-U-^{14}C] triadimenol and sowing in the top-soil of a loess-based grey-brown podzolic soil. 2) What is the relevance of uptake and follow-up supply from the dressed zones of plants in neighbouring rows. 3) What is the extent of uptake and follow-up supply via the roots from dressed zones of neighbouring plants within the same row. 4) What is the course of dressed-zone formation following dry treatment of winter barley and winter wheat and sowing in the top-soil of a loess-based grey-brown podzolic soil. 5) What is the quantitative distribution of the agent on the pericarp of winter wheat caryopses following dry seed treatment. 6) Will the ^{14}C-labelled agent be taken up, too, via the caryopsis and be translocated in scion and root. 7) What are the pathways of the agent from the caryopsis into the embryo. 8) How long will follow-up supply via the scutellum continue. The results concerning issues 1 to 4 were taken from tests with field lysimeters. Experiments concerning issues 6-8 were performed without soil in an climatic chamber.

45213 **Estimating the direct effect of CO_2 on soybean yield.** King, D.A.; Bingham, G.E.; Kercher, J.R. (Univ. of California, Davis). *Journal of Environmental Management;* **20**: No. 1, 51-62(Jan 1985). Contract W-7405-ENG-48.

Plants grown under elevated CO_2 concentrations exhibit higher water-use efficiency and often have higher rates of photosynthesis. In this paper, a method is presented for estimating the direct impact of projected global CO_2 concentration ($[CO_2]$) increases on crop yields. The method computes yield as the product of total seasonal transpiration and transpiration efficiency, defined as (marketable yield/seasonal transpiration). A simple soil-water model is used to estimate the seasonal transpirational of field-grown soybeans (Glycine max (L.) Merr.) as a function of $[CO_2]$. Results from CO_2 fumigation experiments in open-top chambers are then used to estimate soybean transpiration efficiency as a function of $[CO_2]$. Use has been made of several simplifying assumptions to illustrate the technique and provide a preliminary estimate of the magnitude of the CO_2 impact on crops. The results suggest that an increase in $[CO_2]$ would increase US soybean yields, if no concurrent changes in climate or cultural practices occur. 25 references, 6 figures, 1 table.

45214 **Morphological and fertility responses in isogenic triploid and hexaploid pearl millet x napiergrass hybrids.** Gonzalez, B.; Hanna, W.W. (Univ. of Georgia College of Agriculture Experiment Stations, Tifton). *Journal of Heredity;* **75**: 317-318(Jul-Aug 1984). Contract AS09-76EV00637.

The effects of polyploidy on 18 morphological and fertility characters were studied in six isogenic Pennisetum americanum (L.) Leeke x P. purpureum Schum, triploid (3x) and hexaploid (6x) clonal pairs. Four of the characters, inflorescence length and width, floret length, and flag leaf length increased in size for all clones with an increase in ploidy as a result of a dosage effect. Pollen diameter and stainability increased due to a more regular meiosis in the hexaploid (AAA'A'AB) compared to the triploid (AA'B) resulting in functional pollen grains. Differential responses to polyploidy among clones were observed for 12 plant characteristics: stomatal length and frequency on both abaxial and adaxial surfaces, growth rate, tiller number per plant, plant height, stem thickness, days to flowering, flag leaf width, spikelet number per 5 cm inflorescence, and florets per spikelet. The different responses by clones are probably due to any one or combination of a dosage effect, gene number controlling a character, genotype of plant, and gene action and interaction both within and between the A and B genomes. This investigation showed the importance of studying a number of different genotypes when determining the effect of an increase in ploidy level on plant characters.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 43894, 43899, 44419, 44735, 44839, 45015, 45065, 45131, 45146, 45250

45215 **(AECL—7794) MONTEC, an interactive FORTRAN program to simulate radiation dose and dose-rate responses of populations.** Perry, K.A.; Szekely, J.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1983. 73p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701965.

In FORTRAN on PDP-10.

The computer program MONTEC was written to simulate the distribution of responses in a population whose members are exposed to multiple radiation doses at variable dose rates. These doses and dose rates are randomly selected from lognormal distributions. The individual radiation responses are calculated from three equations, which include dose and dose-rate terms. Other response-dose/rate relationships or distributions can be incorporated by the user as the need arises. The purpose of this documentation is to provide a complete operating manual for the program. This version is written in FORTRAN-10 for the DEC system PDP-10.

45216 **(AECL—7828) Study of the health of the employees of Atomic Energy of Canada Limited. II. Implementing the study.** Weeks, J.L.; Johnston, L.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1984. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701966.

The Atomic Energy of Canada Limited Employee Health Study is a program that was established in 1980 to determine, over the long term, the causes of death in a population consisting of some 14,000 AECL employees and past employees. In a previous report (AECL-6813) the steps taken to set up the study were described. The present report is a description of the way in which the study was implemented, and includes discussion of some recent developments that have had a bearing on epidemiological studies of the health of radiation workers.

45217 **(CONF-830695—12) Comparison of the U-233 dog data of Stevens et al. with uranium retention functions in ICRP Publication 30 and a 3-compartment mammillary model for uranium.** Bernard S.R. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016369.

From Health Physics Society annual meeting; Baltimore, MD, USA (19 Jun 1983).

Stevens measured the distribution, retention, and excretion of U-233 in seven beagles each given a single injection of U-233 citrate [2.8 μCi/kg U-233 (VI) (~3 mg/dog)]. These data, when plotted together with results obtained with the ICRP (Pub. 30) retention functions for purposes of comparison, are seen to differ only slightly from the ICRP-30 model. The number of transformations in the body, over a fifty-year period agree within a factor of 2. A three-compartment mammillary model has been parameterized from the data of Stevens by the method of Bernard. Retention in tissues of the body is represented by a linear combination of three compartments. The data plots for the dogs and ICRP-30 model will be presented and discussed together with the three compartment mammillary model for U-233 retention, distribution, and excretion. 3 figs., 2 tabs.

45218 **(FRNC-TH—1820) Evidence and analysis of radioresistance induced by protracted gamma irradiation of Chlorella pyrenoidosa chick, green unicellular alga.** Santier-Riviere, S. (Grenoble-1 Univ., 38 - La Tronche (France)). Jun 1984. 134p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751190.

Chlorella cells, unicellular green algae, are a suitable living material to study radiosensitivity of eucaryotic cells after acute or protracted gamma irradiations. Cell survival and survival curves are taken as end-points. Methods of irradiation were defined taking in account interferences of the different factors which can intervene during the experimentation. Survival curves after protracted irradiation of Chlorella cell cultures in plateau-phase have a shape that can be explained by radioresistance. The population of surviving cells becomes radioresistant in front of protracted and acute irradiations, acute irradiation allowing us to analyze radioresistance. Radioresistance increases with the total dose of protracted irradiation. The decrease of radiosensitivity with aging of cells is not able to explain the phenomenon. It is not due to selection of radioresistance cells by protracted irradiation. All the cells get radioresistance. Radioresistance decreases with the time when protracted irradiation is suppressed. It is not found in offspring. It is not a mutation but perhaps the effect of a stimulation of repair processes, but not potentially lethal damage repair.

45219 **(GSI—85-3) Chromosomal aberrations of the Chinese hamster cell line V79 after irradiation with X-rays and heavy ions.** Mueller, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.)). Feb 1985. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752094.

The study on hand examines chromosomal aberrations in Chinese hamster 79 cells. Irradiation involved a number of heavy ions ranging from neon to uranium with an energy variation between 0.3 and 20 MeV/u. Linear energy transfer ranged from 270 to 16,300 keV/μm. X-ray tests were run for reasons of comparison. Experiments showed the following results: 1) Aberration rate increases in dependence of nuclear charge number or LET resp. 2) The distribution of the chromosome-damage instances found differed markedly from corresponding measurements following irradiation with thinly ionizing radiation. In contrast to x-irradiation, it is possible, therefore, to obtain high aberration yields in preparations made immediately after irradiation. 3) The maximum of aberration yield after heavy-ion irradiation could be shown to occur as early as 4h after irradiation. This is true in x-irradiation for but small doses. 4) The radiation-sensitizing effect of caffeine and its action on the repair system of the cell could be confirmed for x-irradiation and could be described for heavy ions for the first time. 5) The radiation-protection effect of cysteamine could be re-affirmed for thinly ionizing radiation, however, it could not be verified for heavy ions. 6) Irradiation of cells by means of particles of a defined range supports the hypothesis that the particularly radiation-sensitive regions of the nucleus membrane constitute the cell's crucial target.

45220 **(GSI—85-8-Prepr.) HZE effects on mammalian cells.** Kraft, G.; Hieber, L.; Schuber, M.; Blakely, E.A.; Tobias, C.A.; Kraft-Weyrather, W.; Miltenburger, H.G.; Mueller, W.; Wulf, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. Contract AC03-76SF00098. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751885.

In track segment experiments cell survival and chromosome aberrations of mammalian cells have been measured for various heavy ion beams between helium and uranium in the energy range between 0.5 and 960 MeV/u, corresponding to a velocity range of 0.03 to 0.87 c, and an LET spectrum from 10 to 15.000 keV/μm. At low LET, the cross section (sigma) for cell killing increases with increasing LET and shows a common curve for all ions regardless of the atomic number. This indicates that in this region the track structure of the different ions is of only a minor influence, and it is rather the total energy transfer, which is important for cell killing. At higher LET values, deviations from a common sigma-LET curve can be observed which indicate a saturation effect. The saturation of the lighter ions occurs at lower LET values than for the heavier ions. These findings are also confirmed by the chromosome data, where the efficiency for the induction of chromosomal aberrations for high LET particles depends on the track structure and is nearly independent of LET. In the heavier beams ($Z >= 10$) individual particles cause multiple chromosome breaks in mitotic cells.

45221 (IAEA-TECDOC—326, pp 5-15) **Summary report on the use of irradiation as a quarantine treatment of agricultural commodities.** Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

Considerable data are available to demonstrate that gamma irradiation is an effective quarantine treatment for papaya infested with fruit fly species found in Hawaii. These data are acceptable to the USDA-APHIS as a quarantine treatment for this commodity. However, its practical application can be realized only when FDA approves the use of irradiation, either for this purpose alone or as a process of food preservation. Additional data are needed to develop quarantine treatment schedules for irradiation of other commodities such as citrus, stone fruits, tropical fruits, etc., against these and other insect species. For this reason, a Consultant Meeting was convened at the East-West Center, University of Hawaii, Honolulu, Hawaii from 21 to 23 November, 1983, to evaluate existing data and to define future activities to establish the possible use of irradiation as an acceptable quarantine treatment.

45222 (IAEA-TECDOC—326, pp 17-42) **Present status of research on efficacy of quarantine treatment for horticultural crops in the USA with special reference to the use of irradiation as a potential quarantine treatment.** Burditt, A.K. Jr. (Agricultural Research Service, Yakima, WA (USA)). Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

Research on efficacy of quarantine treatments for horticultural crops has been conducted in the United States of America by scientists of the U.S. Department of Agriculture, Agricultural Research Service (ARS), and by scientists in various state research organizations for many years. ARS scientists have been investigating effectiveness of fumigation using volatile chemicals such as ethylene dibromide, methyl bromide, phosphine and others; physical methods including cold, heat, modified atmosphere and gamma irradiation; and biological methods such as host susceptibility and host inspection as treatments for commodities infested by fruit flies and other pests. ARS and state scientists are studying possible adverse effects of such treatments on the commodities. This research also involves cooperation with the U.S. Department of Energy and its contractors, Sandia Laboratories, CH_2M Hill, and Battelle Pacific Northwest Laboratories.

45223 (IAEA-TECDOC—326, pp 43-47) **Possible inspection and control of fruits treated by irradiation to overcome quarantine restrictions.** Amyx, C.M. (Plant Protection and Quarantine, Department of Agriculture, Hyattsville, MD (USA)). Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

Low dose irradiation can be used as a quarantine treatment when a wholesome food additive tolerance is established. The treatment must be fail-safe and offer regulatory officials a treated product that will not likely introduce exotic agricultural pests of concern with the treated product. The Federal domestic and foreign quarantines will have be to revised to provide for irradiation as a treatment. Safeguards are necessary to insure that nontreated products do not leave regulated areas. We will need a means of identifying the treated product in the receiving area. To make an irradiation treatment practical, the market quality research must be linked with the disinfestation of insect research work so that a quality

product is marketed. Consumer acceptance is paramount. The way the treated product is labeled will be a key to market acceptance.

45224 (IAEA-TECDOC—326, pp 49-54) **Status of quarantine treatment of fruits in Australia with special reference to possible application of irradiation.** Rigney, C.J. (Gosford Horticultural Postharvest Lab., New South Wales Department of Agriculture, Gosford (Australia)). Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

Irradiation appears to be the most suitable disinfestation treatment. A dose of 75 Gy breaks the life cycle of Queensland fruit fly, while most fruit are unaffected by this treatment. The wholesomeness of the fruit for the consumer is also unaffected by this low dose treatment. However, for this treatment to be commercially viable, the general international acceptance of irradiated food by consumers is essential.

45225 (IAEA-TECDOC—326, pp 55-59) **Export of tropical fruit from Thailand with special reference to quarantine restrictions imposed by certain importing countries.** Syamananda, R. (Department of Agriculture, Bangkhen, Bangkok (Thailand)). Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

The export markets for tropical fruit from Thailand are presently limited to Hong Kong, Singapore, Malaysia, Europe and the Middle East where plant quarantine regulations are not as rigorous as they are in other parts of the world. Attempts are being made to open up new markets in Japan, Australia and the United States of America. However, in order to gain access to these markets the produce must be completely free of restricted quarantine pests such as oriental fruit fly (Dacus dorsalis) and melon fruit fly (D. Cucurbitae). Many importing countries restrict use of chemicals in agricultural produce by fumigation. The use of irradiation technology for pest problems appears to be an acceptable alternative.

45226 (IAEA-TECDOC—326, pp 61-63) **Experience in operating pilot irradiation facility for treating fruits to satisfy quarantine regulations.** Dollar, A.M. (Hawaii Univ., Honolulu (USA). School of Public Health). Feb 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533. (CONF-8311257—).

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

The Hawaii Development Irradiator was commissioned and placed in service in March of 1967. The facility was a multi-purpose pilot-plant irradiator designed to process packaged products at the rate of 6,000 pounds per hour. The unit was used to treat papaya at a disinfestation dose (less than 0.1 kGy) as part of the quarantine treatment.

45227 (IAEA-TECDOC—326) **Use of irradiation as a quarantine treatment of agricultural commodities. Final report of a consultants group meeting organized by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development and held in Honolulu, Hawaii, 21-23 November 1983.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Feb 1985. 69p. (CONF-8311257—). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781533.

From Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities; Honolulu, HI, USA (21 Nov 1983).

Items within the scope of EDB have been entered individually into the data base. (ACR)

45228 (INFO—0094) **Testing and evaluation of existing techniques for identifying uptakes and measuring retention of uranium in mill workers.** (Monserco Ltd., Mississauga, Ontario (Canada); Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701969.

Preliminary tests and evaluations of existing bio-analytical techniques for identifying uptakes and measuring retention of uranium in mill workers were made at two uranium mills. Urinalysis tests were found to be more reliable indicators of uranium uptakes than personal air sampling. Static air samples were not found to be good indicators of personal uptakes. In vivo measurements of uranium in lung were successfully carried out in the presence of high and fluctuating background radiation. Interference from external contamination was common during end of shift measurements. A full scale study to evaluate model parameters for the uptake, retention and elimination of uranium should include, in addition to the above techniques, particle size determination of airborne uranium, solubility in simulated lung fluid, uranium analysis in faeces and bone and minute volume measurements for each subject.

45229 (INFO—0098) **Correlation analysis of first phase monitoring results for uranium mill workers.** Davis, M.W. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). May 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701970.

This report describes the determination of the existence and extent of correlations in data obtained during the first phase study of urinalysis, personal air sampling and lung burden measurements of uranium mill workers. It was shown that uranium excretions in urine as determined from spot urine samples at the end of the shift were correlated with intakes calculated from personal air sampling data at the 90 percent confidence level. When there are large variations in the rate of urine production, the time rate or uranium elimination was shown to be a more reliable indicator of uranium excretion than the uranium concentration in urine. Based on correlations between phantom and subject lung burden measurements in the presence of changing background radiation levels, a comparative lung burden measurement technique was developed. The sensitivity and accuracy of the method represent a significant improvement and the method is as applicable to females as to males.

45230 (INIS-mf—9334) **Activities in biological radiation research at the AGF.** (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). 1984. 21p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85781558.

The AGF is working on a wide spectrum of biological radiation research, with the different scientific disciplines contributing different methodologies to long-term research projects. The following fields are studied: 1. Molecular and cellular modes of action of radiation. 2. Detection and characterisation of biological radiation damage, especially in humans. 3. Medical applications of radiation effects. 4. Concepts and methods of radiation protection. The studies will lead to suggestions for radiation protection and improved radiotherapy. They may also contribute to the development of environmental protection strategies.

45231 (INIS-mf—9340) **Information value of different methods of dental radiology with special regard to periodontal diagnosis.** Lavrendiadou, E. (Hamburg Univ. (Germany, F.R.). Fachbereich Medizin). 10 Mar 1981. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781568.

The present work illustrates the information value of orthopantomograms and other radiological methods as compared to the ordinary dental film. The material used are phantom skulls and bone preparations. The clinical part furthermore evaluates pictures taken on patients. Given a fair quality of the picture material, orthopantomography, contrary to the opinion of numerous authors, is shown to provide frequently also good results in diseases of the parodontium. In some areas this method is even found to be superior to intraoral pictures. (orig.).

45232 **(JINR—19-84-544) Way of estimating the efficiency of the effect of ionizing radiation and magnetic fields on phage's induction in lysogenic culture of bacteria.** Anosova, M.G.; Danilov, V.I.; Korogodin, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701871.

Submitted to the journal Radiobiology.

In order to estimate the efficiency of ionizing radiations and other agents which induce the phage's production in lysogenic culture of bacteria, the difference ΔN of free phage's particles between experiment and control or the ratio K of these Values could be used. It is obvious that the more adequate is the way of estimation which results at a constant dose weakly depend on fluctuations in control. Taking phage's induction in culture Escherichia coli K12 (lambda) by X-rays and magnetic field as examples, it is shown that K ratio which could be named "induction coefficient" meets well this requirement.

45233 **(JINR—R-19-84-645) Factors determinating the shape of survival curves of Escherichia coli cells irradiated by ionizing radiation with different LET. Peculiarities of genome organization and the shape of survival curves.** Krasavin, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701869.

The basic biological mechanisms realized on molecular, cellular and population levels and stipulating the shape of dependence of the cell suriival (S) on the dose (D) are considered. One of possible causes of nonlinear S(D) dependence are the peculiarities of DNA degradation in E. coli cells. The mechanisms of genetic control of different types of degradation are discussed. Some regularities of the genetic recombination and replication of DNA in E. coli are considered. The conclusion is made that one of the basic stipulating for the shoulder on the survival curves in E. coli are the peculiarities of the chromosome replication.

45234 **(JINR—R-19-84-667) Yeast survival after gamma-irradiation. The effect of delayed colony appearance and determination of relative part of undamaged cells.** Lobachevskij, P.N.; Zamolodchikova, S.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701870.

Submitted to the Radiobiology.

An experimental method to determine both a relative number of cells without lethal damages and the effect of the delayed appearance of colonies of haploid and diploid yeast exposed to ionizing radiation is proposed.

45235 (LMF—113, pp 237-239) **Toxicity of inhaled $^{239}PuO_2$ in aged Beagle dogs. VI.** Muggenburg, B.A.; Hahn, F.F.; Gillett, N.A.; Guilmette, R.A.; Boecker, B.B.; McClellan, R.O. (Inhalation Toxicology Research Institute, Albuquerque, NM). Dec 1984. NTIS, PC A23/MF A01. File Number DE85009283.

In Inhalation Toxicology Research Institute annual report, October 1, 1983-September 30, 1984.

Studies to determine the effects of age at exposure on the metabolism, dosimetry, and biological effects of inhaled particles of $^{239}PuO_2$ are in progress in aged Beagle dogs (8.0 to 10.5 years of age at exposure). Forty-eight dogs inhaled $^{239}PuO_2$ particles with an activity media aerodynamic diameter of 1.5 μm to achieve initial lung burdens ranging from 0.02 to 0.66 μCi ^{239}Pu/kg body weight (0.74 to 24 kBq/kg). Twelve dogs exposed to the aerosol diluent serve as controls. Thirty-nine exposed dogs have died, including four in the past year. The principal causes of death have been radiation pneumonitis and pulmonary fibrosis. Four control dogs have died. The nine surviving exposed dogs and eight controls are continuing to be observed. 1 reference, 2 figures, 1 table.

45236 (RRC—55, pp 8-14) **Radiation accidents: an overview of worldwide experience.** Horan, J.R. (International Atomic Energy Agency, Vienna, Austria). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A radiation accident as defined by Dr. Andrew McLean of the UK National Radiological Protection Board is characterized by unintended intense radiation fields or the uncontrolled release of radioactive materials in such a way as to be capable of causing serious injury or death. Since 1940, there have been approximately 100 such events in the entire world. During the first 20 years there were 17 such accidents or about one per year. During the second 20 year period, 82 radiation accidents occurred averaging about 4/year. 4 tabs. (DT)

45237 (RRC—55, pp 15-19) **Onsite and offsite emergency planning.** Subbaratnam, T.; Sarma, M.S.R.; Rao, K.P. (Bhabha Atomic Research Centre, Bombay, India; Rajasthan Atomic Power Station, Kota, India; Tarapur Atomic Power Station, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The emergency plan, termed in this paper as the Standard Emergency Plan (SEP), aims to enable each individual facility to modify it to suit its particular setup and the type of accidents envisaged for that facility. Also, in a given site, there may exist other installations in the vicinity which may or may not handle radioactive materials. Any accident in these installations may affect a nuclear facility either directly or indirectly. The SEP seeks to provide for remedial actions in such situations as well. (DT)

45238 (RRC—55, pp 108-111) **External accident dosimetry (summary).** Spurny, Z. (Institute of Radiation Dosimetry, Prague, Czechoslovakia). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The primary purpose of nuclear accident dosimetry is to provide, in case of an accident, a rapid assessment of radiation doses for the guidance of the medical services (the appropriate treatment of more heavily exposed persons and for reassuring personnel who have been only lightly exposed). A rapid dose assessment is also desirable for public relations reasons. 10 refs. (DT)

45239 (RRC—55, pp 112-114) **Internal accident dosimetry (summary).** Spurny, Z. (Institute of Radiation Dosimetry, Prague, Czechoslovakia). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A brief description of methods employed to assess radiation doses consequent to accidental ingestion of radionuclides. 9 refs. (DT)

45240 (RRC—55, pp 154-155) **Exotic problems in radiation accidents (summary).** Spurny, Z. (Institute of Radiation Dosimetry, Prague, Czechoslovakia). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A list of typical small-scale radiation accidents is provided. (DT)

45241 (RRC—55, pp 156-159) **Reconstruction of radiation accidents (summary).** Spurny, Z. (Institute of Radiation Dosimetry, Prague, Czechoslovakia). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Dose to critical organs must be estimated as early and as accurately as possible since the dose received by a person dictates medical care to be delivered. In general, the knowledge of the dose received in an accident will guide individual medical care, will determine future employment of exposed individuals, and will provide scientific information. 1 ref. (DT)

45242 (RRC—55, pp 160-172) **Basic biological effects of radiation.** Phondke, G.P. (Bhabha Atomic Research Centre, Bombay, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Exposure of any biological material to radiation results in alteration of its properties. This is termed as the radiation damage of the biological system. The damage may be structural or functional. The nature and extent of the damage would depend not only on the characteristics of the particular biological system but also on the quality of the radiation. 7 tabs.

45243 (RRC—55, pp 173-177) **Assessment of radiation dose by biological indicators.** George, K.P. (Bhabha Atomic Research Centre, Bombay, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The biological indicators of radiation damage are useful in assessing the radiation dose from the response of the irradiated organism. Under well defined experimental conditions there exists good correlation between the dose and the biological damage. These relationships are such that one can make a reasonably accurate estimate of the dose from the biological damage. A good number of biological end points have been found useful for these purposes. To be of practical value, the indicators should show a dose-dependent response, be highly sensitive, should not vary depending on the disease or metabolic changes of the organism at the time of exposure, and be useful in the clinical management of the patient. This discussion emphasizes the practical aspects of the problem and is aimed at its application to human situations. 8 refs.

45244 (RRC—55, pp 178-186) **Health detriment following radiation exposure.** Madhvanath, U.; Subrahmanyam, P.; Somasundaram, S. (Bhabha Atomic Research Centre, Bombay, India). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

With the currently followed permissible dose limits (50 mSv/yr whole body) and the ALARA principle of ICRP, radiation workers throughout the world receive on an average about 6 mSv/yr or less. The index of harm works out to be 1.75 (manyear per year 1000 employed). This value is equivalent to a mortality rate of 45×10^{-6} yr^{-1} in an occupation involving no radiation exposure and compares well with several of the safe industries. Considering a particular group of 55,000 workers in power reactors in USA who receive an average dose of 3.9 mSv/yr (collective dose of 220 manSv/yr), the health detriment in terms of additional cancer deaths works out to 2.2. 14 refs. (DT)

45245 (RRC—55, pp 187-189) **Absorption of radioisotopes from skin and wound.** Suzuki-Yasumoto, M. (National Institute of Radiological Sciences, Chiba, Japan). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

One of the important routes in which radioisotope gets into the body is through the surface of the skin. Accidents of internal contamination have occasionally occurred and sometimes are dangerous, particularly in the case of alpha emitters. 3 refs. (DT)

45246 (RRC—55, pp 190-191) **Medical aspects of radiation accidents treated in France.** Nenot, J.C. (Institut de Protection et de Surete Nucleaire, Fontenay-aux-Roses, France). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The French experience in Radiation Accidents has started in 1956. The organization is based on a close collaboration between the Institut Curie and the Department of Protection (Commissariat a l'Energie Atomique). The follow-up of patients is based on 199 observations, among which 56 suffered from acute local radiolesions. Most of the accidents were due to the industrial use of radiation sources such as cristallography (X rays) and gammagraphy (^{192}Ir), or with the industrial and experimental use of ^{60}Co. The patients who suffered acute whole-body irradiation were much less numerous. (DT)

45247 (RRC—55, pp 192-220) **Collection of helpful items for medical evaluation of ionizing radiation exposure cases: Los Alamos National Laboratory.** Voelz, G.L. (Los Alamos National Lab., NM). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Report LA-UR-82-1659.

This collection of miscellany provides information designed to help physicians to evaluate and treat radiation cases. 22 refs., 2 figs., 2 tabs. (DT)

45248 (RRC—55, pp 228-229) **WHO collaborating centers for emergency medical assistance: Paris Center.** Nenot, J.C. (Institut de Protection et de Surete Nucleaire, Fontenay-aux-Roses, France). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

A brief description of the facility and of the duties of the Department of Radiopathology of the Radium Institute of Paris is provided. (DT)

45249 (RRC—55, pp 237-245) **Concept and derivation of Emergency Reference Levels (ERLs).** Lister, B.A.J. (Atomic Energy Research Establishment, Harwell, England). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

In spite of difficulties, following a major accident the Emergency Controller may have to take urgent decisions on a wide variety of topics, some involving the site and its personnel, others the general public. He is more likely to make these decisions correctly and rapidly if a substantial part of the assessment work can be done in advance. In particular, he will be helped by guides which give him some indication of the level of dose, or of some environmental quantity more easily measured than dose, below which countermeasures are not likely to be needed and above which he should consider seriously their adoption. 3 tabs. (DT)

45250 (UCRL—92883) **Determination of somatic mutations in human erythrocytes by cytometry.** Jensen, R.H.; Langlois, R.G.; Bigbee, W.L. (Lawrence Livermore National Lab., CA (USA)). 21 Jun 1985. Contract W-7405-ENG-48. 10p. (CONF-8506137—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016082.

From 4. international conference on environmental mutagens; Stockholm, Sweden (24 Jun 1985).

Flow cytometric assays of human erythrocytes labeled with monoclonal antibodies specific for glycophorin A were used to enumerate variant cells that appear in peripheral blood as a result of somatic gene-loss mutations in erythrocyte precursor cells. The assay was performed on erythrocytes from 10 oncology patients

who had received at least one treatment from radiation or mutagenic chemotherapy at least 3 weeks before being assayed. The patients were suffering from many different malignancies (e.g., breast, renal, bone, colon and lung), and were treated with several different mutagenic therapeutics (e.g., cisplatinum, adriamycin, daunomycin, or cyclophosphamide). The frequency of these variant cells is an indication of the amount of mutagenic damage accumulated in the individual's erythropoietic cell population. Comparing these results to HPRT clonogenic assays, we find similar baseline frequencies of somatic mutation as well as similar correlation with mutagenic exposures. 9 refs., 3 figs., 1 tab.

45251 **Promotion of septation in irradiated Escherichia coli by a cytoplasmic membrane preparation.** Gill, J.S.; Adler, H.I. (Oak Ridge National Lab., TN). *Radiation Research;* **102**: No. 2, 232-240(May 1985). Contract W-7405-ENG-26.

Septation can be promoted in an X-irradiated lon mutant of Escherichia coli K-12 by the addition of an E. coli B/r cytoplasmic membrane preparation to the postirradiation plating medium. The promotion of septation was not associated with an inhibition of growth rate. Two distinct cytoplasmic membrane-associated properties were necessary to promote septation. One of these, the cytochrome-based electron transport system, produced anaerobic conditions by the reduction of oxygen dissolved in the medium. The second system, functioning independently from the first, altered substances found in the peptone and yeast extract components of the postirradiation plating medium. When both systems were operative, significant repair of the cell division mechanism occurred.

45252 **Therapeutic dosimetry for Cf-252 neutron brachytherapy of pelvic cancer.** Maruyama, Y.; Beach, J.L.; Hazle, J.; Ashtari, M.; Schroy, C.B.; Olson, M.H. (Univ. of Kentucky, Lexington). *International Journal of Radiation Oncology, Biology and Physics;* **11**: No. 5, 927-935(May 1985).

^{252}Cf (Cf) was used to treat tumors of the cervix and uterus with neutron brachytherapy (NT) in an ongoing clinical trial. Tandem and ovoids insertions were used and combinations of single and multiple applications along with high dose whole pelvic irradiation. Dosimetric analysis of treated cases for patterns of tissue dose were carried out. Tissue dose for Cf-NT was, in general, high for neutron components in the central pelvis only, and fell off rapidly with distance from the applicators. The majority and balance of therapeutic dose was contributed by low linear energy transfer (LET) high energy photon beam radiation to the whole pelvis. Comparison with fast neutron beam therapy (NBT) isodose curves showed that much more homogeneous neutron dose was delivered to the pelvic tumor and organs by NBT. Complication frequency has been reported to be higher for neutron beam therapy than for Cf-NT. It appears that the higher integral neutron biological dose to normal tissues for NBT compared to intracavitary Cf-NT probably contributed to the frequency of side effects.

45253 **Repair of radiation-induced DNA damage in rat epidermis as a function of age.** Sargent, E.V.; Burns, F.J. (New York Univ. Medical Center, NY). *Radiation Research;* **102**: No. 2, 176-181(May 1985). Contract AC02-76EV03380.

The rate of repair of radiation-induced DNA damage in proliferating rat epidermal cells diminished progressively with increasing age of the animal. The dorsal skin was irradiated with 1200 rad of 0.8 MeV electrons at various ages, and the amount of DNA damage was determined as a function of time after irradiation by the method of alkaline unwinding followed by S_1 nuclease digestion. The amount of DNA damage immediately after irradiation was not age dependent, while the rate of damage removal from the DNA decreased with increasing age. By fitting an exponential function to the relative amount of undamaged DNA as a function of time after irradiation, DNA repair halftimes of 20, 27, 69, and 107 min were obtained for 28, 100-, 200-, and 400-day-old animals, respectively.

45254 **Distribution of ^{110}Ag-silver nitrate prophylaxis solutions following eyedrop application to the albino rabbit.** Lambrecht, R.M. (Brookhaven National Lab., Upton, NY (USA)); Packer, S. (Brookhaven National Lab., Upton, NY (USA); North Shore Univ. Hospital, Manhasset, NY (USA). Div. of Ophthalmology; Cornell Univ., New York (USA). Medical Coll.). *Nuclear Medicine Communications;* **6**: No. 4, 245-247(Apr 1985).

The distribution of radioactive silver-110 labelled silver nitrate in the eye of the albino rabbit was determined by eyedrop application of 1, 2 and 6% solutions. The distribution of the radiotracer was determined at 1 h and 1 day post-application. Localization at 1 h was primarily in the cornea and conjunctiva. Washout of this radiotracer was rapid.

45255 **Calculation and interpretation of in situ measurements of initial radiations at Hiroshima and Nagasaki.** Loewe, W.E. (Lawrence Livermore National Lab., CA (USA)). pp 138-155, 193 of Proceedings of the US-Japan joint workshop for reassessment of atomic bomb radiation dosimetry in Hiroshima and Nagasaki. Hiroshima, Japan; RERF (1983). (CONF-830209—).

From US/Japan joint workshop on the reassessment of A-bomb radiation dosimetry in Hiroshima and Nagasaki; Nagasaki, Japan (16 Feb 1983).

The ultimate purpose of this Dosimetry Workshop is to establish the values and the associated limit of uncertainty of the initial nuclear radiation reaching the ground at the time of the A-bomb explosions in Hiroshima and Nagasaki. These explosions were physically complex phenomena and the events of long ago, accordingly large undesirable errors arise in the theoretical and computational analogies and extrapolation. Therefore, any in situ evidence which is related directly to the initial radiation has a potentially supreme value for the determination of the actual initial radiation. The realization of that potential depends on the closeness of the relation between the observed quantity and absorbed dose, the accuracy and completeness of record keeping, and the inherent uncertainty in the observation itself. The results of the careful calculation of neutron and gamma radiations were compared with the existing measured values of the gamma-ray dose in roof tiles and face bricks and also of the cobalt activation inside concrete pillars. The cobalt calculation is reviewed, and the similar comparison of the sulfur activation in the insulators on power transmission lines is discussed in this workshop. The topics on the cobalt and sulfur activation are described.

5602 Thermal Effects

45256 **(AECL—7830) Modification of thermal sensitivity of Chinese hamster cells by exposure to solutions of monovalent and divalent cationic salts.** Raaphorst, G.P.; Azzam, E.I.; Vadasz, J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jun 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701959.

Chinese hamster V79 cells were heated in culture medium or in 0.155-mol.dm^{-3} solutions of LiCl, NaCl, KCl, $MgCl_2$, $CaCl_2$ and $BaCl_2$. The presence of any one of these ionic solutions during heating increased the thermal sensitivity of the cells. The order of increased thermal sensitivity was KCl > LiCl > NaCl for the monovalent salts and $BaCl_2$ > $MgCl_2$ > $CaCl_2$ for the divalent cation salts. The addition of glucose to LiCl or NaCl solutions did not reduce the thermal sensitization caused by these solutions. When cells were sensitized by LiCl or NaCl treatment, a change in pH from 7.2 to 6.6 did not further increase thermal sensitivity. These data show that nutrient and ionic factors and their interplay are involved in cellular thermal sensitivity.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 43621, 43621, 43661, 43666, 43666, 43676, 43738, 43767, 43914, 43915, 43916, 44768, 45094, 45097, 45098, 45150, 45170

45257 (BNL—51885) Biological effects summary report: pyrene. Keimig, S.D.; Pattillo, R.W. (Brookhaven National Lab., Upton, NY (USA)). Nov 1984. Contract AC02-76CH00016. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017010.

A comprehensive review of pyrene was conducted to assess the potential health effects of this polyaromatic hydrocarbon (PAH) and to evaluate the need for recommending an interim occupational exposure limit to protect the health of exposed workers. Pyrene is formed as a trace pollutant during incomplete combustion of organic matter. Concentrations of pyrene in urban and industrial settings are generally higher than the levels recorded for benzo(a)pyrene. Concentrations of pyrene vary but are usually less than 50% of the total PAH, depending on the industry sampled. In humans, pyrene is a photosensitive material. Acute photo irritation effects may persist as chronic skin discoloration for as long as five months. No other documented clinical or epidemiological studies were found on effects of pure pyrene. There is evidence of co-carcinogenicity of pyrene and benzo(a)pyrene in mice. There is no clear evidence that pyrene is a tumor initiator. At this time, we do not recommend that a standard be set specific to pyrene in mixtures since available data on biological effects are limited, and since possible effects due to interactions of pyrene and the myriad of polynuclear aromatic compounds present during typical exposures have not been assessed. An exposure limit of 0.1 mg/m^3 would likely prevent photosensitization and irritation effects of pure pyrene. We recommend that the coal tar pitch volatile standard (CTPV) continue to be used for mixtures containing less than 50% pyrene. All exposures should be as low as reasonably achievable since in animals, pyrene appears to be a co-carcinogen with benzo(a)pyrene. 112 refs., 11 tabs.

45258 (BNL—51903) Biological effects summary report: 4,4'-methylenedianiline. Bernholc, N.M.; Morris, S.C. III; Brower, J.E. (Brookhaven National Lab., Upton, NY (USA)). May 1985. Contract AC02-76CH00016. 56p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017376.

The Center for Assessment of Chemical and Physical Hazards was requested by the Department of Energy (DOE) to develop a Biological Effects Summary Report for 4,4'-methylenedianiline (MDA). The literature regarding MDA toxicity was reviewed and a risk assessment analysis was performed based on animal tumor data, structurally similar compounds, and human effects data. In man, acute exposures to MDA have caused epigastric pain, fever, jaundice, and oher symptoms consistent with hepatitis. These effects appear to be reversible. No liver damage has yet been observed from chronic exposure. Chronic skin effects disappear when MDA exposure stops. Skin sensitivity also occurs in some individuals. Recent findings suggest a link between exposure to MDA and the occurrence of bladder cancer in man. Studies indicate that the skin is a major route of exposure in the development of these health effects. In animals, chronic administration of MDA produces hepatic cirrhosis, liver lesions, and enlargement of the spleen, liver, and kidneys. MDA has also proved to be carcinogenic in rats and mice, causing liver, thyroid and several other tumors. Compounds structurally similar to MDA are also known to be carcinogenic in man and animals. Based on these findings, an interim exposure limit of 0.08 mg/m^3 (0.01 ppM) was recommended for an average concentration exposure to employees during an 8-h work shift. 52 refs., 5 figs., 16 tabs.

45259 (CONF-8406210—2) Studies on the tumor initiating, tumor promoting, and tumor co-initiating properties of respiratory carcinogens. Nesnow, S.; Triplett, L.L.; Slaga, T.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016387.

From Symposium on tumor promotion and enhancement in the etiology of human and experimental respiratory tract carcinogenesis; Williamsburg, VA, USA (17 Jun 1984).

With mouse skin as the bioassay model, the multifaceted behavior of chemicals and mixtures can be elucidated using the protocols of tumor initiation, tumor promotion, tumor co-initiation, and complete carcinogenesis. In addition to studies with individual respiratory carcinogens, we report the tumorigenic and carcinogenic effects of complex environmental mixtures. We sought to compare the potency of human respiratory carcinogens, based on epidemiological data, with the bioassay potency data obtained from mouse skin tumor initiation and mouse skin complete carcinogenesis experiments as well as the bioassay potency data obtained from short-term genetic toxicology bioassays. Three human respiratory carcinogens were used: emissions from coke ovens, emissions from roofing tar pots, and cigarette smoke. When the potency obtained from mouse skin tumor initiation experiments of these materials was compared with the potency based on human respiratory cancer, a surprisingly close correlation was observed. 10 refs., 18 figs., 5 tabs. (DT)

45260 (CONF-8503163—1) Assessing the transport and fate of bioengineered microorganisms in the environment. Barnthouse, L.W.; Palumbo, A.V. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1985. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016964.

From Workshop on risk assessment methods for biotechnology; Washington, DC, USA (28 Mar 1985).

We review the methods currently available for quantifying the transport and fate of microbes in atmospheric and aqueous media and assess their adequacy for purposes of risk assessment. We review the literature on transport and fate of microorganisms, including studies of: (1) pathways of migration, (2) the survival of microorganisms during transport and fate. In addition, we review the transport and fate models that have been used in environmental risk assessments for radionuclides and toxic chemicals and evaluate their applicability to the problem of assessing environmental risks of bioengineered microorganisms.

45261 (CONF-8504170—1) Electron reactions in model and biological systems. Bakale, G. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology). 1985. Contract AC02-78EV04746. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016062.

From DOE radiological and chemical physics contractors' meeting; Richland, WA, USA (9 Apr 1985).

Our pulse-conductivity studies of electrons in nonpolar liquids and reversed-micellar solutions in which electron mobilities, μ/sub e/'s, that range from $<10^{-3}$ to $>10^3$ cm^2/Vs and electron-attachment rate constants, k/sub e/'s, that range from $<10^8$ to $>10^{14}$ M^{-1}s^{-1} will be briefly described as well as the mechanisms of electron transport and attachment that are consistent with this millionfold range of μ/sub e/'s and k/sub e/'s. Included among the electron-attachment results presented will be the k/sub e/'s of >150 chemicals that have been classified using animal tests as being carcinogens or noncarcinogens. The k/sub e/-carcinogenicity correlation will be compared with the bacterial mutagenicity-carcinogenicity correlation which is the basis of the Ames Salmonella bioassay, the short-term test that is most widely used to screen potentially carcinogenic chemicals. Finally, our use of the Ames Salmonella tester strains as a biological detector of electrophilic carcinogens will be discussed. 5 refs., 1 tab. (DT)

45262 (CONF-8506137—13) Role of metabolism in benzo(a)pyrene carcinogenesis. Selkirk, J.K.; Merrick, B.A.; Schaeffer, E.L.; Mann, R.A.; Mansfield, B.K. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017313.

From 4. international conference on environmental mutagens; Stockholm, Sweden (24 Jun 1985).

The effect of acetic acid or trifluoroacetic acid additions to methanol-water mobile phase used in the high performance liquid chromatographic resolution of benzopyrene conjugates is detailed. In a separate set of experiments cloned mice tumor cells separated by a fluorescence activated cell sorter were shown to exhibit differences in their monooxygenase system. Thirdly cells were treated with hexamethylene bisacetamide. Two dimensional electrophoresis

of cytoplasmic proteins revealed only 251 proteins as compared with 421 proteins from control cultures. 7 refs., 6 figs. (DT)

45263 **(CONF-8508108—1) Cadmium resistance in Drosophila: a small cadmium binding substance.** Jacobson, K.B.; Williams, M.W.; Richter, L.J.; Holt, S.E.; Hook, G.J.; Knoop, S.M.; Sloop, F.V.; Faust, J.B. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017303.

From 2. international meeting on metallonthionein; Zurich, Switzerland (21 Aug 1985).

A small cadmium-binding substance (CdBS) has been observed in adult Drosophila melanogaster that were raised for their entire growth cycle on a diet that contained 0.15 mM $CdCl_2$. Induction of CdBS was observed in strains that differed widely in their sensitivity of $CdCl_2$. This report describes the induction of CdBS and some of its characteristics. 17 refs., 4 figs., 1 tab.

45264 **(DOE/BP—376) Epidemiology and control of infectious diseases of salmonids in the Columbia River Basin. Annual report, FY 1983.** Fryer, J.L. (Oregon State Univ., Corvallis (USA). Dept. of Microbiology). Nov 1984. Contract AI79-83BP11987. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015783.

Infectious diseases are responsible for severe losses in Columbia River Basin salmonids. Successful propagation and enhancement of this fisheries resource requires control of these diseases. This study focuses on three serious fish pathogens: Ceratomyxa shasta, Renibacterium salmoninarum, and infectious hematopoietic necrosis virus. Knowledge gained will be useful in developing control measures for these pathogens and the application of these ideas will be of direct benefit in the successful rehabilitation of salmon stocks in the Columbia River Basin.

45265 **(DOE/ER/60158—1) Environmental carcinogens in human target tissues in culture. Progress report.** Hsu, I.C. (Maryland Univ., Baltimore (USA). School of Medicine). 19 Oct 1984. Contract AS05-83ER60158. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017188.

The metabolism and mutagenicity of 1-nitropyrene, 1-aminopyrene, 2-aminofluorene and acetylaminofluarene in hepatic cell cultures is investigated. Metabolic products were assayed by thin-layer chromatography. Ancillary studies on Ames' assary mutagencity screening, unscheduled DNA synthesis by hepatocytes and binding to nuclear structures are also reported. 1 fig., 1 tab.

45266 **(DOE/ER/60174—1) Development of an in vitro assay for teratogens. Progress report, 1 July 1983-31 August 1985.** Braun, A.G. (Massachusetts Inst. of Tech., Cambridge (USA)). 1985. Contract AC02-83ER60174. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017233.

An in vitro teratogen assay system was applied to samples of fossil fuel combustion products. Potential teratogenicity was measured by the ability of a test compound to inhibit the attachment of tumor cells to lectin coated plastic surfaces. 13 refs., 3 tabs. (DT)

45267 **(DOE/EV/10586—1) [Effects of sulfur dioxide and respirable particulates on pulmonary function in human subjects]. Progress report, January 1, 1981-December 31, 1981.** (Maryland Univ., Baltimore (USA)). 1982. Contract AS05-81EV10586. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017126.

Five nonsmoking adult male human volunteers have been exposed to SO_2 and respirable ammonium sulfate aerosol, per protocol. The study protocol used was a 3-week exposure routine. A preliminary analysis of the pulmonary function data shows that a strong trend toward significance occurred in SGaw (Specific Airway Conductance) associated with the SO_2 exposure and with the combined exposure to SO_2 and respirable ammonium sulfate aerosol. This trend did not occur with the separate aerosol exposure. Mild symptoms with exposure were experienced by a few subjects. (DT)

45268 **(DOE/EV/10586—2) [Effects of sulfur dioxide and respirable particulates on pulmonary function in human subjects].** (Maryland Univ., Baltimore (USA)). 2 Aug 1982. Contract AS05-81EV10586. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017127.

Thirteen males were exposed to sulfur dioxide (10 ppM) and ammonium sulfate aerosols. No significant changes in pulmonary function from inhalation of these aerosols have been found. (DT)

45269 (EPA—902/9-75-001, pp 88-95) **Health effects of acid aerosols.** French, J.G. (National Environmental Research Center, Research Triangle Park, NC). Nov 1975. NTIS. (CONF-7505158—; EEP—1).

From Conference on emerging environmental problems: acid precipitation; Rensselaerville, NY, USA (19 May 1975).

An attempt is made to describe the health effects which have been identified with inhalation of certain acid aerosols in ambient air. Numerous studies are cited which indicate the levels of suspended sulfates associated with certain adverse health effects were lower than the levels of SO_2 and total suspended particulates associated with the same health effect.

45270 (EPRI-EA—2273, pp 2) **Evaluation of the effects of acid precipitation on forest ecosystems using microcosm simulators: joint project TVA-ORNL.** Strickland, R.C.; Kelly, J.M.; Edwards, N.T. 1981. NTIS, PC A05/MF A01. File Number DE82903148. (CONF-8103126—).

From Ecological effects of acid precipitation conference; Atlanta, GA, USA (4 Mar 1981).

Twenty forest microcosms were established to evaluate the effect of simulated acid rain on: (1) plant nutrient content and foliar leaching rates; (2) leaf morphological and physiological responses; (3) decomposition rates in litter and mineral soil; and (4) leaching rates of soil nutrients. Each microcosm consisted of a 1.2-m^2 box containing a reconstructed soil profile which supports two tulip poplar, two Virginia pines, and two white oak trees and associated litter. Microcosms were arranged in groups of four under five shelters (replications) which had sliding roofs designed to cover the microcosms during natural precipitation events. At other times, the microcosms were exposed to the ambient environment. Treatments were applied weekly through sprayers located under the shelter roofs. Microcosms under each shelter received one of four different pH levels of simulated acid rain. These treatments were calculated to give annual weighted pH averages of 5.7 (control), 4.5., 4.0, or 3.5. Plant nutrient content was determined from foliage analysis, and foliar leaching rates were measured from throughfall collected during each treatment event. Leaf morphological differences among treatments were evaluated microscopically on foliage samples. Photosynthesis, respiration, transpiration, leaf expansion rates, and senescence were used to evaluate physiological effects.

45271 **(EPRI-EA—4203) Field air-exclusion system for measuring the effects of air pollutants on crops. Final report.** Thompson, C.R. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Aug 1985. 117p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920811.

An air exclusion system was designed, constructed and tested to determine its effectiveness in plant air pollution studies. The system provided both reductions in ambient oxidants and additions of sulfur dioxide to a plant canopy. The system design included particulate and activated charcoal filters, pressure-type blowers, a mixing manifold, and perforated inflatable ducts which were positioned between rows of plants. Carbon monoxide tests indicated optimal system parameters for air exclusion including: air flow of at least 0.944 $m^3\ s^{-1}$ within the ducts, three or four rows of holes on the side of each duct pointing 45° upward, 90° to the side, and 45° downward from the center of the duct, four ducts per system, and a hole size that provided an air velocity of 0.5 to 1.8 m s^{-1} over the plant canopy. No large environmental differences were found between air exclusion systems and open top chambers versus outside plots in the summer. In the fall and winter open top chambers had higher air, leaf and soil temperatures than air exclusion systems or outside plots. Air speed over the plant canopy was higher with the air exclusion system than in open top chambers or outside plots.

Based on the previous tests a smaller model air exclusion was designed and tested for use at remote sites. This system provided for oxidant exclusions of alfalfa plants comparable to the exclusion with the fixed systems, but at lower cost and with greater flexibility for use. 36 refs., 20 figs., 48 tabs.

45272 **(PB—226314) Effects of sulfur oxides in the atmosphere on vegetation: revised chapter 5 for air quality criteria for sulfur oxides.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Research and Development). Sep 1973. 54p. (EPA—R3-73-030). NTIS, PC A04/MF A01.

The following subjets are addressed: symptoms of the effects of SO_2 on plants; mechanism of action; factors affecting plant response to SO_2; problems in diagnosis and assessment of the economic impact of SO_2; effects on lower organisms; acid precipitation; miscellaneous aspects of SO_2 on plants; effects on biomass and yield; and dose-response relationships to plants. 141 references, 6 tables.

45273 **Covalent binding of benzo[a]pyrene diol epoxide to DNA of mouse skin: in vivo persistence of adducts formation.** Shugart, L. (Oak Ridge National Lab., TN). *Journal of Toxicology and Environmental Health;* **15**: No. 2, 255-263(1985). Contract AC05-84OR21400.

In the first 9 d after topical application of a single dose of benzo[a]pyrene to the dorsal skin of C_3H mice, the half-lives of benzo[a]pyrene diol epoxide-DNA adducts and of DNA were determined to be approximately 5 d. These data indicate that, in proliferating mouse skin, benzo[a]pyrene diol epoxide-DNA lesions are not repaired, but are diluted from the genome at a rate equivalent to DNA turnover (i.e., replication versus degradation). Subsequent to this initial period, benzo[a]pyrene diol epoxide-DNA adduct removal continues, but at a much reduced rate. At 30 d posttreatment with benzo[a]pyrene, approximately 15% of the adducts are still detectable; however, their half-lives had increased to 30 d. Similar experiments with a hairless mouse showed that, although the amount of adduct formation was lower initially, the kinetics of aduct disappearance and persistence were essentially the same as found with the C_3H mouse. The data obtained in this work are consistent with the hypothesis that benzo[a]pyrene diol epoxide adducts persist in a subpopulation of skin cells long after their disappearance by DNA turnover would predict.

45274 **Measuring effects of air pollution stress on forest productivity: perspectives, problems, and approaches.** McLaughlin, S.B.; West, D.C.; Blasing, T.J. (Oak Ridge National Lab., TN). *Tappi;* **67**: No. 1, 74-80(Jan 1984). Contract W-7405-ENG-26.

Changing levels and patterns of emissions of atmospheric pollutants in recent decades have resulted in increased exposure of extensive forests in Europe and North America to both gaseous pollutants and acid rain. Reports of decreased growth and increased mortality of forest trees in areas receiving high rates of deposition of atmospheric pollutants have emphasized the need to better understand and quantify both the mechanisms and kinetics of potential changes in forest productivity. The complex chemical nature of combined pollutant exposures and the fact that these changes may involve both direct effects to vegetation as well as indirect and possibly beneficial effects mediated by a wide variety of soil processes make quantification of such effects particularly challenging. A variety of productivity studies in Europe and the US have been evaluated. Dendroecological approaches, which combine detailed analysis of long-term growth trends as influenced by tree age, competitive status, climatic variables, and pollutant levels, offer great promise for quantifying both the temporal and spatial relationships of productivity changes and their relationship to patterns of deposition of atmospheric pollutants. Subsequent research to delineate mechanisms of effects and simulate the long-term integrative effects of altered tree growth and soil nutrient dynamics will be required to provide a streng scientific basis for establishing cause-and-effect relationships between air pollution and changes in forest productivity. 42 references.

45275 **Comparison of experimental designs used to detect changes in yields of crops exposed to acidic precipitation.** Evans, L.S.; Thompson, K.H. (Manhattan College, Bronx, NY). *Agronomy Journal;* **76**: 81-84(Jan-Feb 1984). Contract AC02-76CH00016.

A comparison of experimental designs used to detect changes in yield of crops exposed to simulated acidic rain was performed. Seed yields were determined from field-grown soybeans (Glycine max L.) exposed to simulated rainfalls in which all ambient rainfalls were excluded by automatically moveable rainfall exclusion shelters. When all eight, 4 x 4, latin squares were used, simulated rainfalls of pH 4.1, 3.3, and 2.7 exhibited yields 10.6, 16.8, and 23.9%, respectively, below yields of plants exposed to pH 5.6. The linear component of pH treatment differences showed a highly significant decrease in yield ($p < 0.001$). The eight latin squares analyzed as individual experiments yielded erratic conclusions. However, when all eight latin squares were combined a satisfactory evaluation can be made. The low probability value for differences among latin squares ($p < 0.005$) indicates that field locations are a legitimate source of stratification. Sources of variation are also highly significant for both pooled among rows within squares ($p = 0.0028$) and the pooled among columns within squares ($p = 0.0168$) indicating that the two stratifications within each latin square was doubly effective in reducing the residual error term. The relative efficiency of the latin square to a randomized complete block design, and a completely randomized design was 132-146 and 162%, respectively.

45276 **Estimation of the frequency of malformed sperm by slit scan flow cytometry.** Halamka, J.; Gray, J.W.; Gledhill, B.L.; Lake, S.; Wyrobek, A.J. (Univ. of California, Livermore). *Cytometry (Baltimore);* **5**: 333-338(1984). Contract W-7405-ENG-48.

An investigation was made of the utility of Slit Scan Flow Cytometry (SSFCM) for measuring the frequencies of malformed sperm heads in control and mutagen treated B6C3F1/CRL mice. In SSFCM, fluorescence profiles of sperm heads stained with the DNA-specific fluorescent dye acriflavine were recorded for sperm flowing lengthwise through a 2.5-μm-thick laser beam. Malformed sperm were detected as having fluorescence profiles that differed substantially from an average fluorescence profile for sperm from untreated mice. Fluorescence profiles were measured for 500 sperm per mouse from five control mice, five mice injected intraperitoneally daily for 5 days with a total of 375 mg/kg of body weight methyl methane sulfonate (MMS), and for 30 mice injected intraperitoneally daily for 5 days with total doses of procarbazine ranging from 125 mg/kg to 1250 mg/kg. Sperm were collected from the caudae epididymides 35 days after the last injection. Frequencies of malformed sperm in these samples were also estimated by visual analysis. All samples were analyzed in double blind fashion. The visual and SSFCM malformed sperm frequencies for the samples from control, MMS-treated, and procarbazine-treated mice were correlated. A dose effect was seen with both the visual and SSFCM estimates for the sperm from the procarbazine-treated mice. 8 references 3 figures.

45277 **Effects of simulated acidic rain on yields of field-grown soybeans.** Evans, L.S.; Lewin, K.F.; Patti, M.J. (Brookhaven National Lab., Upton, NY). *New Phytologist;* **96**: 207-213(1984). Contract AC02-76CH00016.

An experiment was performed during the summer of 1982 to determine the effects of simulated acidic rain on seed yields on two commercial cultivars of soybeans grown according to standard agronomic practices. Plants were shielded from all ambient rainfalls automatically by two moveable exclusion covers and exposed to simulated rainfalls in quantities equal to the average amount of rainfall that occurs at the site. Seed yields of cv. Amsoy exposed twice weekly to simulated rain of pH 4.1, 3.3 and 2.7 were, respectively, 3.0, 9.0, and 12.8% below yields of plants exposed to simulated rain of pH 5.6. A treatment-response function of seed yield vs rainfall pH for Amsoy was $y = 10.20 + 0.587\ x$ and had a correlation coefficient of 0.96 (y is seed mass per plant and x is the pH of the simulated rain). For cv. Williams, seed yields of plants exposed to simulated rainfalls of pH 5.6, 4.1, 3.3 and 2.7 were 11.5, 10.5, 11.4 and 11.4 g, respectively. A treatment-response function of seed

yield vs rainfall pH for Williams was y = 11.13 + 0.016 x which had a correlation coefficient of 0.038. Plants of Amsoy and Williams grown in plots adjacent to the exclusion shelters had mean seed yields of 11.4 and 9.8 g per plant, respectively. Seed yield per plant was dependent upon number of pods per plant because the number of seeds per pod did not vary among treatments for each cultivar. 13 references, 1 figure, 1 table.

45278 **Effects of simulated rain acidified with sulfuric acid on host-parasite interactions.** Shriner, D.S. (Oak Ridge National Lab., TN). pp 55 of First international symposium on acid precipitation and the forest ecosystem. Columbus, OH; Ohio State University (1975). (CONF-750552—).

From 1. international conference on acid precipitation and the forest ecosystem; Columbus, OH, USA (12 May 1975).

Wind-blown rain, rain splash, and films of free moisture play important roles in the epidemiology of many plant diseases. The effects of simulated rain acidified with sulfuric acid were studied on several host-parasite systems. Plants were exposed, in greenhouse or field, to simulated rain of pH 3.2 +/- 0.1 or pH 6.0 +/- 0.2. Simulated rain of pH 3.2 resulted in: (1) an 86% inhibition in telia production of Cronartium fusiforme on Quercus phellos; (2) a 66% inhibition of reproduction of Meloidogyne hapla on field-grown Phaseolus vulgaris; (3) a 10% decrease in the severity of Uromyces phaseoli on field-grown Phaseolus vulgaris; and (4) inhibited Rhizobium nodulation of Phaseolus vulgaris and Glycine max by an average of 73%. Effects on halo blight of kidney bean (caused by Pseudomonas phaseolicola) depended upon the segment of the disease cycle in which the rain occurred: (a) simulated rain of pH 3.2 applied to plants before inoculation stimulated disease development; (b) suspension of inoculum in rain of pH 3.2 decreased inoculum potential; and (c) rain of pH 3.2 applied to plants after infection inhibited disease development. Scanning electron microscopy of epicuticular waxes on leaves of Quercus phellos and Phaseolus vulgaris showed marked erosion of those surfaces by rain of pH 3.2, indicating possible influences on the structure and function of plant cuticles. These results suggest that the acidity of rain is a new parameter of environmental concern, and underline the need for study of the consequences of prolonged exposure of both agronomic and natural ecosystems to this form of stress.

45279 **Ozone suppression of white pine net photosynthesis.** Botkin, D.B.; Smith, W.H.; Carlson, R.W. (Yale Univ., New Haven, CT). *Journal of the Air Pollution Control Association;* **21**: No. 12, 778-780(Dec 1971).

Reduction in rates of net photosynthesis following exposure to ozone was observed in eastern white pine saplings prior to the development of visible injury. Branches exposed to consecutive doses of 50-80 pphM ozone for 4 hr and 80-90 pphM ozone for 3 hr appeared to have suppressed net photosynthetic rates but results were confounded by diurnal rate variation. Photosynthetic rates of treated branches returned to normal levels following this initial ozone exposure. A second ozonation involving dosages of 90-100 pphM for 5 and 3 hr was sufficient to reduce rates of net photosynthesis by approximately 80%. 13 references, 1 figure.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 45232

45280 **(EPRI-EA—4159) Effects of 60-Hz electric fields on living plants exposed for extended periods. Final report.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.). Jul 1985. 175p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920810.

The effects of intense 60-Hz electric fields were studied by exposing plants of five kinds (crops) for extended periods in a special greenhouse where cultural and environmental factors could be controlled. Plant populations and densities simulated field conditions. While exposed, plants of all crops germinated satisfactorily, and plants of sweet corn and wheat completed their life cycles and produced viable seed. Plants of alfalfa and tall fescue were at the early bloom stage when harvested. Exposure of plants of five kinds to electric fields had no statistically significant effects on seed germination, seedling growth, plant growth, phenology, flowering, seed set, biomass production, plant height, leaf area, plant survival, and nodulation. Exposure to 60-Hz electric fields resulted in very limited damage to terminal leaf tips, awns, and corn tassels, particularly at fields of 30 kV/m or greater. 47 refs., 36 figs., 44 tabs.

45281 **(EPRI-EA—4189) Design, construction, and testing of a dc bioeffects enclosure for small animals. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC06-76RL01830. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85016798.

Large air-ion concentrations moving in high-strength static electric fields are unique to the environment near high-voltage dc (HVdc) transmission lines. To assess the possible biological effects of this environment, a small-animal exposure system was designed to produce well-characterized levels of the major components of the HVdc environment. Initial steps in the development of this exposure system included studies of various housing geometries and housing materials. Dielectric materials, such as plexiglass and lexan, unacceptably perturbed electric-field and air-ion environments in their vicinity; these perturbations depended on the cleanliness of the housing materials and were spatially and temporally variable. Semiconducting materials were also investigated, with satisfactory results. The final cage design employs semiconducting glass walls which span the entire space between the grounded metal-screen cage floors and the overhead high-voltage electrodes used to generate the exposure electric fields. The surface conductivity of the glass walls is controlled by a system of energized guard strips located on the outer surfaces of the walls. Electric-field strengths up to 100 kV/m and air-ion concentrations up to $10^6/cm^3$ are attainable. Initial dosimetric measurements were also performed as part of this project. The ion current collected by the body of a grounded animal was measured as a function of ion concentration and electric-field strength. The ion current collected by a live animal was observed to be significantly less than that collected by a conducting animal model of similar size and shape. This deviation appears to be due to accumulation of electric charge on the fur of exposed animals. 71 refs., 42 figs., 3 tabs.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 43759, 45068

45282 **(EPRI-CS/EL—4104) Workshop proceedings: PCB by-product formation.** Komai, R.Y.; Addis, G. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1985. 161p. (CONF-841269—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920731.

From PCB by-product formation workshop; Palo Alto, CA, USA (4 Dec 1984).

Fires involving PCB-filled transformers occur infrequently, but concern exists about the release of potentially toxic combustion by-products. Responding to proposed EPA regulations on PCB-filled building transformers, experts gathered to review current information on the partial-oxidation products of PCB.

45283 (RRC—55, pp 221-227) **Training programmes and experiences of medical emergency preparedness for radiation accident in Japan.** Suzuki-Yasumoto, M. (National Institute of Radiological Sciences, Chiba, Japan). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

Our policy of training programmes for medical radiation emergency preparedness is described. We found it is necessary to have two approaches to the training of relevant personnel. The first approach was to conduct adequate basic training of nurses and health physics personnel in large nuclear installations for medical radiation emergency preparedness. We found it was necessary to have courses for basic knowledge of nuclear radiation and industrial activities, radiation monitoring procedures, radiation injuries, human counters and wound monitors, first aid practices, and radiation medical emergency procedures including practices. The second approach was to make a simple and introductory training

program on the subject using lectures and visual presentations in the vicinity of big nuclear installations for personnel relating to the nuclear industrial activities and for concerned local personnel, including medical doctors and nurses. These two training courses and approaches were planned and have been conducted. 2 refs. (DT)

45284 (RRC—55, pp 230-236) **International assistance and cooperation.** Collins, H.; Bernardo, B.; Horan, J. (International Atomic Energy Agency, Vienna, Austria). 1982. NTIS (US Sales Only), MF A01. File Number DE85900956. (CONF-8111228—).

From Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects); Kalpakkam, India (30 Nov 1981).

The International Atomic Energy Agency (IAEA) has, over two years, exhibited increasing interst and activity in emergency planning and preparedness as it relates to the safety of nuclear facilities. The Agency's first formal action in this area occurred in 1959 with the establishment of the Agency's Radiation Emergency Assistance Plan. Subsequently, the Agency has published a number of documents that deal with, or are related to, emergency planning and preparedness matters. The Agency also conducted a number of symposia and conferences during these years which addressed these matters either wholly or in part. (DT)

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 43863, 43878, 43882, 43886

45285 **(BRGM-RA—1982-Pt.1) Scientific and technical results of BRGM in 1982: activity analysis.** (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1982. 79p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750558.

This book reports and analyses works carried out in 1982 by the BRGM, it presents the activities 1982 according to the different trends of research: basic research (geology, fracturation, remote detection and image processing, data bases and banks); planning (water and public service, water and research activities, hydrogeochemistry, underground storage, safety, and environment); raw materials (polymetallic sulfides and subsea hydrothermal activity, mineralizations linked to granitoid and continental hydrothermal activity, mineralizations linked to basic and ultrabasic rocks, phosphates, materials, hidden deposit detection methodology, boring valorization and aid to mining development, research on geophysical techniques, research on analytical techniques, mineral processing); and energy (solid fuels and new energies).

45286 **(BRGM-RA—1982-Pt.2) Scientific and technical results of BRGM in 1982: main results.** (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1982. 215p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85750559.

This book is a sum-up of some researches presented under a note form and presents the list of reports and publications realized during the same year 1982. The different trends of researches which are presented cover the following fields: basic research, planning, raw materials and energy (see also the BRGM-RA--1982 part 1 report).

45287 **(CONF-850775—1) Unusual occurrence of maghemite in soils developed on Knox group dolostones.** Kopp, O.C.; Lee, S.Y. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017158.

From International clay mineral conference; Denver, CO, USA (28 Jul 1985).

Maghemite, γ-Fe_2O_3, occurred in soils developed from residuum of Knox group dolostones (Cambro-Ordovician age) along Chestnut Ridge on the US Department of Energy Oak Ridge Reservation in Oak Ridge, Tennessee. The parent dolostones in the area, although exposed to weathering, were free of maghemite and magnetite. Scanning electron micrographs and electron probe analyses indicated that the maghemite occurred in several textural types, including replaced oolites, cemented siltstones, and massive to botryoidal material. The most complex replacement by maghemite was revealed by the oolitic texture variety. Oolitic limestone was dolomitized, as revealed by the presence of numerous rhombs, during early diagenesis. During a period of silicification dolomite rhombs were replaced, and much of the remaining oolites and carbonate cements may have been partially replaced. More recently, after uplift and erosion brought these oolitic cherts into the upper weathering zone, the cherts were replaced by iron oxides. Massive chert and siltstone grains in all stages of replacement have been observed. The replacing iron in the soil solution may have originated from ferrous-ferric hydroxide, carbonate, or organic complexes. The replaced iron was converted to maghemite and hematite through dehydration and slow oxidation during pedogenesis. 17 refs., 5 figs., 1 tab.

45288 **(CONF-8508103—1) Streamflow monitoring with ultrasonic recorders.** Melroy, L.A.; Huff, D.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016308.

From Conference on hydraulics and hydrology in the small computer age; Orlando, FL, USA (13 Aug 1985).

In September 1983, four new streamflow monitoring sites were established in a west Chestnut Ridge catchment at the Oak Ridge National Laboratory. Ultrasonic level/flow recorders were used to monitor the streamflow at these sites. These recorders use an ultrasonic sound pulse and digital circuitry to measure the stage or flow. By use of a FROM (functional read only memory), the recorder can operate in a linear or proportional mode. In the linear mode, the data are recorded as a fraction of a predetermined maximum stage, and in the proportional mode, the data are recorded as a fraction of a predetermined maximum flow. Data are recorded on an EPROM (erasable programmable read only memory) which can later be translated using an Apple IIe microcomputer with an interface card. EPROMs are erased using an ultraviolet lamp but circular charts on the recorders provide a permanent pen and ink stage or flow record. New computer software was developed for the Apple IIe to meet the specific needs of streamflow reporting, because the available software was aimed at the water and wastewater industry and provided overly extensive reports. The new software is designed to read the EPROM and convert the hexadecimal data to decimal data, then store the data on a disk. An editing program allows the user to estimate any lost data or correct any erroneous data. A report generator computes the streamflow based on a stage-flow rating table and generates a daily summary report which provides the total flow volume, the average flow, and the daily maximum and minimum flow.

45289 **(LA-UR—85-2454) Experiments with non-Darcy flow in joints with large scale roughness.** Cornwell, D.K.; Murphy, H.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-8509129—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015714.

From International symposium on fundamentals of rock joints; Bjorkliden, Lapland, Sweden (15 Sep 1985).

Joints are normally in contact at roughness asperities; consequently the relative roughness, the ratio of the asperity protrusion to the mean flow aperture, is approximately one, which is orders of magnitude greater than that encountered in more usual situations such as pipe and channel flows. In our experiments the joint roughness was idealized with sawtooth corrugations. We found that Darcy's Law became invalid for Reynolds numbers greater than about 100. Hence, for most of our studies the flow was non-Darcian, and so we adopted the usual convention of representing pressure losses in terms of an apparent friction factor. When the roughness peaks were aligned, resulting in maximum flow disturbance, the friction factor increased when the relative roughness was increased, simulating the closure of a joint due to normal-direction loading. However, when the roughness peaks were 180° out of phase, so that peaks were opposite valleys, the friction factor initially increased with greater relative roughness, but then decreased. 2 refs., 8 figs., 2 tabs.

45290 **(NUREG/CR—3736) Field and theoretical investigations of fractured crystalline rock near Oracle, Arizona.** Jones, J.W.; Simpson, E.S.; Neuman, S.P.; Keys, W.S. (Arizona Univ., Tucson (USA). Dept. of Hydrology and Water Resources). Aug 1985. 114p. NTIS, PC A06/MF A01 - GPO. File Number TI85902090.

A combination of geophysical and hydraulic testing has been conducted in granite near Oracle, Arizona. The purpose of the work is to determine relationships, if any, among (1) fracture distribution, (2) geophysical properties, and (3) hydraulic properties of fractured rock of low hydraulic conductivity. To date, eight vertical borings spaced 20 to 50 feet apart, ranging from 250 to 300 feet in depth, have been drilled. The data obtained from neutron, gamma, acoustic-velocity, electrical-resistivity, and acoustic-televiewer logs, with the results of over 100 single-hole, straddle-packer injection tests make possible a detailed description of the fracture system. Geophysical logs readily detect fractures and are sensitive to subtle lithologic variations of the granite. Orientation and distribution of individual fractures were determined from interpretation of the acoustic-televiewer data, and from the analysis of core obtained from one borehole. Fracture densities over the 13-foot long straddle-packer test intervals did not correlate with measured hydraulic conductivity for each interval. A strong correlation between the neutron-log response and measured hydraulic conductivity does exist; it was used to supplant conductivity mesurements. The geostatistical technique of kriging provided a three-dimensional map of hydraulic conductivity that can be compared with subsurface interpretations of the geophysical logs. 52 refs., 42 figs., 8 tabs.

45291 **(PNL-SA—13177) Understanding, testing and development of stochastic approaches to hydrologic flow and transport through the use of the multigrid method and synthetic data sets.** Cole, C.R.; Foote, H.P.; Zimmerman, D.A.; Simmons, C.S. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 17p. (CONF-8506124—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016280.

From International symposium on the stochastic approach to subsurface flow; Montvillargenne, France (2 Jun 1985).

A "numerical groundwater laboratory" approach is being developed at Pacific Northwest Laboratory to address basic groundwater system characterization and modeling issues. The philosophical theme that motivates this approach is that computation can extend theoretical science by allowing the macroscopic manifestations of simple basic laws that describe a phenomenon to be developed by the computer. The premise is that higher level equations have been "developed as much for their mathematical simplicity as for their capacity to model the salient features of a phenomenon." The numerical laboratory approach can be used as a tool for investigating, developing an understanding of, and testing various proposed methods for addressing various issues. The issues of conern are related to the many legitimate and haunting questions regarding the validity of the convective-dispersion equation and the realization that the parameter identification problem and the closely associated problem of spatial variability are two of the greatest difficulties facing the hydrologist. The assumption required for our approach is that modeling convective transport at the representative elementary volume (REV) scale with only molecular diffusion is sufficient to simulate the observed macroscopic manifestations groundwater transport. We believe that existing computational methods, specifically the multilevel adaptive solution technique coupled with image-processing software, are adequate to develop the numerical laboratory approach. Initial results from our numerical laboratory experiments seem to support our assumption that the basic laws of convection and diffusion at the REV scale can describe the macroscopic manifestations of transport. We recognize that the final test will, as always, rest with our ability to successfully transfer the knowledge gained using this computation approach to demonstrations in the field. 16 refs., 6 figs.

45292 (SAND—84-0288, pp 83-85) **Seismogenic crustal stresses as inferred from in situ stress measurements in a stratified crust.** Leary, P. (Univ. of Southern California, Los Angeles). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45293 (SAND—84-0288, pp 86-96) **Continental scientific drilling program data base - 1983.** Pawloski, G.A.; Howard, N.W. (Lawrence Livermore National Lab., CA). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—). Contract W-7405-ENG-48.

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45294 (SAND—84-0288, pp 103-105) **Fractured igneous rock environment test pit results.** Mathews, M.A.; Scott, J.; LaDelfe, C.M. (Los Alamos National Lab., NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45295 (SAND—84-0288, pp 116) **New method of fluid velocity measurement in porous media.** Dunn, J.C. (Sandia National Labs., Albuquerque, NM). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45296 **(SAND—85-0023) Marker Bed 139: a study of drillcore from a systematic array.** Borns, D.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016831.

In southeastern New Mexico, Marker Bed 139 (referred to in this report as MB139) is one of 45 numbered siliceous or sulfatic units within the Salado Formation of the northern Delaware Basin. MB139 is divided into five zones. Zones I and V are the upper and lower contact zones, respectively. Zone II is a syndepositionally deformed subunit of polyhalitic anhydrite. Zone III is mixed anhydrite and polyhalitic anhydrite, a distinctive pale-green and pink, with subhorizontal fractures. Zone IV consists of interlayered halite and anhydrite without the overprint of polyhalite. This sequence was transitional between submarine and subaerial. The anhydritic units of MB139 formed in salt-pan or mudflat environments or both. Undulations observed along the upper contact of MB139 are interpreted to result from traction deposits or from reworking of the upper portion of the marker bed during the transition from anhydrite to halite deposition. Zones II and III exhibit soft-sediment deformation and later traces of dewatering; e.g., formation of stylolites. Such deformation is not observed in the halite above MB139 or in Zone V and the halite units below MB139. A distinctive set of subhorizontal fractures occurs in MB139 in mid-Zone III and, to some extent, in Zone IV. These fractures are partially infilled with halite and polyhalite. Brine occurrences at the mined facility horizon at the Waste Isolation Pilot Plant may be related to these fractures. The fractures formed either in response to stress cycles that were functions of sedimentation and erosion, or in response to deformation in the underlying Castile Formation. The subhorizontal orientation, dominant in the sampling to date, is more consistent with the interplay between stress and sedimentation cycles.

45297 **(SAND—85-1128) Theory for dynamic compaction of wet porous solids.** Drumheller, D.S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017596.

Partially-saturated porous media exhibit complex behavior including plastic distortion, irreversible crushing of pores, and dilatancy. Pressure produced by compression of the pore fluid has a strong influence on these phenomena and greatly alters the response observed in the wet solid from that observed in the dry solid. This paper descibles these phenomena within the framework

of a theory for immiscible mixtures. It shows how a material representation originally derived for the hydrostatic compaction of a dry solid can be generalized to wet solids subjected to both distortional and volumetric deformation. Results of stress-wave calculations are compared to data obtained from a field test in which high explosive was detonated in a formation of partially-saturated ashfall tuff.

5802 Geophysics

REFER ALSO TO CITATION(S) 43716, 43759, 44174, 45069, 45285, 45286, 45307

45298 **(CEA-CONF—7787) Quality factor in earth crust by analysis and modelling of Lg waves.** Campillo, M.; Bouchon, M.; Plantet, J.L. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1984. 29p. (In French). (CONF-841274—1). NTIS (US Sales Only), PC A03. File Number DE85752371.

From AGU fall meeting; San Diego, CA, USA (3 Dec 1984).

Lg waves are peculiarly well fitted to seismic wave attenuation in earth because they are superposition of multi-reflected wave S and, so, they have a limited field of propagation and strong amplitudes on an extended range of epicentral distances. The aim of this report is to study the frequency dependence of the quality factor Q for the earth crust of the center of France, by grouping data analysis and numerical modelling. In this study, the Lg waves are recorded by the CEA LDG (Laboratoire de Detection et de Geophysique). Results are consistent with the interpretation of Q frequency variation as a tectonic indicator.

45299 **(CONF-8510118—2) Guidelines for earthquake ground motion definition for the eastern United States.** Gwaltney, R.C.; Aramayo, G.A.; Williams, R.T. (Oak Ridge National Lab., TN (USA); South Carolina Univ., Columbia (USA). Dept. of Geology). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016959.

From DOE natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

Guidelines for the determination of earthquake ground-motion definition for the eastern United States are established in this paper. Both far-field and near-field guidelines are given. The guidelines were based on an extensive review of the current procedures for specifying ground motion in the United States. Both empirical and theoretical procedures were used in establishing the guidelines because of the low seismicity in the eastern United States. Only a few large to great ($M > 7.5$) sized earthquakes have occurred in this region, no evidence of tectonic surface ruptures related to historic or Holocene earthquakes have been found, and no currently active plate boundaries of any kind are known in this region. Very little instrumented data has been gathered in the East. Theoretical procedures are proposed so that in regions of almost no data a reasonable level of seismic ground motion activity can be assumed. The guidelines are to be used to develop the Safe Shutdown Earthquake, SSE. A new procedure for establishing the Operating Basis Earthquake, OBE, is proposed, in particular for the eastern United States. The OBE would be developed using a probabilistic assessment of the geological conditions and the recurrence of seismic events at a site. These guidelines should be useful in development of seismic design requirements for future reactors. 17 refs., 2 figs., 1 tab.

45300 **(NUREG/CR—4354) Study of seismicity and tectonics in New England. Final report.** Ebel, J.E. (Boston Coll., Weston, MA (USA). Weston Observatory). Aug 1985. 99p. NTIS, PC A05/MF A01 - GPO. File Number TI85902061.

The operation by Weston Observatory of a seismic network in New England from 1974 to 1985 is described, and the results of the seismic monitoring are summarized. The network coverage of Weston Observatory increased from 2 operating stations in 1974 to 36 stations in 1979 and was stabilized at 30 stations in the early 1980's. The network was used to find the locations and magnitudes of all earthquake activity detected during the study period. Most earthquakes from 1974 to 1985 were found to occur in the same places as those which have been documented historically, although the activity appears to be randon both in space and time. Studies of aftershocks and detailed monitoring in selected areas did not show any strong correlations between the earthquake locations and mapped geologic structures. It is concluded that the relationships among earthquakes, tectonic or structural zones and faults exposed on the surface are not well understood. The causes of the earthquake activity in the northeast are not clearly established with the seismic data which was gathered and analyzed. 41 refs., 50 figs., 6 tabs.

45301 **(PB—85-192748/XAB) Seismic and resistivity methods of geophysical exploration. Final report.** Henbest, O.J.; Erinakes, D.C.; Hixson, D.H. (Soil Conservation Service, Washington, DC (USA). Engineering Div.). Aug 1971. 179p. NTIS, PC A09/MF A01.

This technical release is designed to acquaint geologist, engineers, and soil scientists with the types of seismic and resistivity equipment adaptable to Soil Conservation Service (SCS) use, and the results and application that can be expected from the equipment. A brief discussion of seismic refraction and resistivity theory is presented. Operation techniques for such topics as use of dynamite, energy sources, electrode configurations and types of surveys are described. Computations of time-distance graphs and seismograms, derivation of the two layer formula, ohm-feet method, and Barnes Layer Method are discussed. Extensive sections are presented on interpretation, along with numerous figures and tables, and estimated cost data for performing seismic and refraction surveys. A discussion of complementary usage of surveys, geophysical reports, and contracting for geophysical surveys is also included.

45302 (SAND—84-0288, pp 101-102) **3-component borehole magnetometer probe for geologic research.** Scott, J.H.; Olson, G.G. (Geological Survey, Denver, CO). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45303 (SAND—84-0288, pp 53-55) **Scientific applications of BHTV and sonic logging.** Moos, D. (Lamont-Doherty Geological Observatory, Palisades, NY). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45304 (SAND—84-0288, pp 56-58) **Modelling of fracture-generated tube waves in VSPs.** Beydoun, W.B.; Cheng, C.H.; Toksoez, M.N. (Massachusetts Institute of Technology, Cambridge). Mar 1984. NTIS, PC A06/MF A01. File Number DE84010626. (CONF-8311148—).

From Workshop on borehole measurements and interpretation in scientific drilling: identification of problems and proposals for their solution; Albuquerque, NM, USA (15 Nov 1983).

45305 **(UCID—20504) Inversion of Rayleigh wave phase velocities between RSNT and RSON.** Randall, G.E.; Taylor, S.R. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013242.

Rayleigh wave phase velocities in the Canadian Shield are estimated for the path between RSNT and RSON in the period range of 10 to 100 sec. Frequency dependent stacking techniques are employed to form an estimate of phase velocity from a limited data set of marginal quality. Inversion of the phase velocities for shear velocity structure indicates an average crustal thickness of 40 km which is consistent with results from previous studies. The lower crustal velocities from our study appear to be slightly greater than those from other studies and Sn velocities along the path are about 4.7 km/s. The effectiveness of the frequency dependent stacking techniques confirms the assumption of signal-independent background noise dominating the records for periods less than

about 30 sec and signal-dependent multipathing noise dominating for periods longer than about 40 sec. 14 refs., 5 figs., 2 tabs.

45306 **Deep seismic sounding with nuclear explosives in the Soviet Union.** Scheimer, J.F.; Borg, I.Y. (Univ. of California, Livermore; Lawrence Livermore National Lab., CA). *Science (Washington, D.C.);* 226: No. 4676, 787-792(16 Nov 1984). Contract W-7405-ENG-48.

A large geophysical program of exploration that uses deep seismic sounding has been under way in the Soviet Union for decades. Underground nuclear explosives have been used as strong seismic sources since 1971. The wide spacing between these seismic sources-for example, 500 kilometers-has permitted seismic exploration of inaccessible areas in traverses up to 3000 kilometers in length. During the same time an ultra-deep drilling program has also been under way. The data gathered have been used to elucidate details of the crust as well as to describe layering and inhomogeneities in the underlying mantle. By Soviet account, deep seismic sounding has been instrumental in confirming the existence of numerous sedimentary structures containing oil and gas fields in western and eastern Siberia. 36 refs., 1 tab., 5 figs.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 43871, 43876

45307 **(AD-A—153690/3/XAB) Study of sound attenuation in sediments. Final technical report.** Addison, S.R.; Bass, H.E. (Mississippi Univ., University (USA). Physical Acoustics Research Lab.). Dec 1984. 73p. NTIS, PC A04/MF A01.

Doctoral thesis.

This dissertation describes an experimental method by which the low-frequency attenuation of compressional waves in a sediment may be measured in the laboratory. The Biot and Hamilton models of sound propagation through sediments are reviewed. Measurements of attenuation in one laboratory sediment are presented, and the measured attenuation is compared to the predictions of the Biot and Hamilton models. The functional dependence of the attenuation measurements is of the form predicted by the Biot model, although the actual magnitude of the measured attenuation is higher than expected. The excess attenuation may be explained by the incomplete de-gasification of the sediment.

45308 **(SAND—85-0266C) Random fracture nucleation and interaction in one dimension.** Kipp, M.E.; Grady, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 15p. (CONF-850770—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014641.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

In a one-dimensional fragmentation problem, such as illustrated by a rapidly expanding ring, fragments are formed by explicit fractures. Recently, we have described the local stress release and energy dissipation process of such a fracture as it progresses from nucleation to completion. During unloading, waves communicate to neighboring fractures at speeds governed by momentum diffusion which is considerably less than the elastic sound speed. We have combined this explicit fracture process with a random nucleation law, to describe the complex interaction of growing fractures that leads to multiple fragmentation. During the time to fragmentation, some fractures may be selectively arrested, depending on the competing effects of tensile loading intensity and rate of nucleation. Concepts are explored at the extremes of behavior where energy limitations or available fracture sites dominate the distribution. Although uncertainties exist in the form of the nucleation law, the calculated fragmentation process is consistent in trend with data available for expanding metal rings. 9 refs., 5 figs.

45309 **^{57}Fe Moessbauer spectra of natural and synthetic hastingsites, and implications for peak assignments in calcic amphiboles.** Thomas, W.M. (Univ. of California, Los Angeles). *American Mineralogist;* 67: No. 5-6, 558-567(May-Jun 1982).

In order to test the validity of unique assignments of ^{57}Fe Moessbauer spectral peaks to individual crystallographic sites in hornblendes, spectra were collected for six synthetic hastingsites, ideally $NaCa_2Fe_4^{2+}Fe^{3+}Si_6Al_2O_{22}(OH)_2$, and for three natural hornblendes of similar compositions. The synthetic, end-member hastingsites are inferred from compositional constraints to have the M(1), M(2), and M(3) sites filled entirely with iron and to have little or no iron in the M(4) site. Thus, these samples provide a test of peak-to-site correspondence. These results suggest that the ferrous absorption has a characteristic shape independent of iron concentration and that the ferrous doublets cannot be assigned to sites uniquely to yield accurate site populations for hornblendes. The observed ferrous area fractions cannot be explained by peak broadening due to octahedral next-nearest-neighbor effects, although it is possible that the presence of neighboring tetrahedral aluminum may be a dominant factor in perturbing the areas of the ferrous doublets.

45310 **Fluorine end-member micas and amphiboles.** Petersen, E.U.; Essene, E.J.; Peacor, D.R.; Valley, J.W. (Univ. of Michigan, Ann Arbor). *American Mineralogist;* 67: No. 5-6, 538-544(May-Jun 1982).

The near end-member minerals fluorphlogopite (XF = 0.96) and fluortremolite (XF = 0.82) have been found in Greenville marbles near Balmat, New York. These micas and amphiboles, like other fluorine-rich minerals reported in the literature, are extremely low in iron. The substitution of F for OH is partly responsible for stabilizing these minerals in the granulite facies marbles of the Adirondacks. Fluorine-rich amphiboles and micas are more common than generally recognized. A literature review shows that many amphiboles and micas have more than fifty percent of the interlayer site occupied by fluorine. This degree of solid solution qualifies these phases as independent minerals, but they are not currently recognized by the I.M.A. Identification of the mineralogically and petrologically important solid solution of fluorine for hydroxyl is currently obscured by use of names that imply hydroxyl end-members.

45311 **Reaction pigeonite = diopside/sub ss/ + enstatite/sub ss/ at 15 kbar.** Schweitzer, E. (State Univ. of New York, Stony Brook). *American Mineralogist;* 67: No. 1-2, 54-58(Jan-Feb 1982).

On the join enstatite-diopside at 15 kbar, the reaction pigeonite = diopside/sub ss/ + enstatite/sub ss/ is in equilibrium at 1465 +/- 10°C. The compositions of the three coexisting phases are (mole percent): pigeonite = Wo/sub 18.3/En/sub 81.7/ (+/-1.5); enstatite = Wo/sub 5.5/En/sub 94.5/ (+/-1.0); diopside = Wo/sub 28.5/En/sub 70.5/ (+/-3.5). Experiments were done in a piston cylinder apparatus using trace amounts of water as a flux, and were reversed to establish equilibrium compositions.

45312 **Polarized optical absorption and ^{57}Fe Moessbauer study of pegmatitic muscovite.** Finch, J.; Gainsford, A.R.; Tennant, W.C. (Dept. of Scientific and Industrial Research, Petone, New Zealand). *American Mineralogist;* 67: No. 1-2, 59-68(Jan-Feb 1982).

^{57}Fe Moessbauer spectra and polarized absorption spectra in the region 4000-6800A are reported for 14 common pegmatitic muscovites, 12 of which were selected from an extensive pegmatite complex. They were chosen to cover a wide range of color types (deep green, green, red-green and ruby-red) and ferric/ferrous ion ratios. Optical absorption properties are discussed in terms of the Fe^{2+}, Fe^{3+} distribution in the M1 and M2 sites. Background absorption, and hence depth of color, appears to be determined primarily by an intense metal-ligant charge transfer which peaks in the UV and the intensity of which correlates linearly with the Fe^{2+} concentration in the normally unoccupied M2 site. The presence or absence of the Fe^{2+}-Fe^{3+} metal-metal charge transfer bands in the region 5000-6000A gives rise to the red and green hues observed in the muscovites studied.

45313 **Crystal structure of a pink muscovite from Archer's Post, Kenya: implications for reverse pleochroism in dioctahedral micas.** Richardson, S.M.; Richardson, J.W. Jr. (Iowa State Univ., Ames). *American Mineralogist;* 67: No. 1-2, 69-75(Jan-Feb 1982).

The crystal structure of a reverse pleochroic muscovite containing both Fe^{3+} and Mn^{3+} has been determined by standard single-crystal X-ray methods. The mica has a $2M_1$ polytype, space group C 2/c. Average bond lengths in tetrahedral sites are 1.646 A and 1.639A, compatible to bond lengths in Si-Al tetrahedra of other analyzed muscovites, but also compatible with minor site occupancy by Fe^{3+}. Mean bond strengths and electron densities for the sites are also compatible with but do not require minor amounts of tetrahedral Fe^{3+}. A pleochroic mechanism related to tetrahedral Fe^{3+}, therefore, cannot be ruled out. Thermal vibration ellipsoids of atoms in the octahedral layer, however, are oriented with long axes perpendicular to the layer, which suggests the possibility that reverse pleochroism is due instead to an unusual configuration of d-orbitals for octahedrally-coordinated Fe^{3+} or Mn^{3+}.

45314 **Hydrous pyriboles and sheet silicates in pyroxenes and uralites: intergrowth microstructures and reaction mechanisms.** Veblen, D.R.; Buseck, P.R. (Arizona State Univ., Tempe). *American Mineralogist;* **66**: No. 11-12, 1107-1134(Nov-Dec 1981).

A wide variety of intergrowth microstructures have been observed with high-resolution transmission electron microscopy in eight different pyroxene specimens that have been partially or wholly altered to other minerals. The product phases of the alteration reactions include amphibole, clinojimthompsonite, chain-width disordered pyribole, and several sheet silicates. The microstructures indicate that in addition to multiple paths for reaction, there may be multiple mechanisms by which a specific reaction may occur. Replacement of pyroxene by amphibole takes place in such a way that multiple nucleation events may result in several different types of out-of-phase boundaries in the product amphibole. The distinction between exsolution and alteration reaction as a mechanism for the formation of narrow amphibole lamellae in pyroxenes is chemical, rather than structural. The determination of which mechanism has operated must therefore be based on chemical and textural arguments. It is concluded that all cases of pyroxene replacement by amphibole that have been reported are at least consistent with an alteration mechanism, while the textures occurring in some specimens are clearly inconsistent with an exsolution mechanism.

45315 **Influence of CO_2 on melting of model granulite facies assemblages: a model for the genesis of charnockites.** Wendlandt, R.F. (Lunar and Planetary Institute, Houston, TX). *American Mineralogist;* **66**: No. 11-12, 1164-1174(Nov-Dec 1981).

Partial melting studies at crustal pressures in SiO_2-rich portions of the system $KAlSiO_4$-Mg_2SiO_4-H_2O-CO_2 can be used to model the anatectic origin of charnockites. The univariant reaction phlogopite + sanidine + quartz + vapor = enstatite + liquid produces a SiO_2-rich melt (granite analog) at 3 kbar; the vapor composition at the solidus is buffered to high H_2O-contents by the coexistence of phlogopite with its breakdown products. At higher pressures, 8 and 15 kbar, the fluid phase is buffered to higher CO_2-contents and the melt composition becomes enriched in K_2O and MgO (charnockite analog). Melting relations are controlled by the expansion of the quartz liquidus field relative to the enstatite and sanidine fields with increasing pressure. Partial melts generated at the base of the crust in the presence of a CO_2-rich fluid will be of an alkaline nature and will crystallize enstatite at lower pressures. CO_2-saturated melting of similar SiO_2-rich bulk compositions (phlogopite-absent) by the reaction enstatite + sanidine + quartz + CO_2 = liquid occurs at temperatures in excess of 1000°C to about 15 kbar. Liquid compositions show analogous trends, however, with increasing pressure, to those observed in the 5-component system as a consequence of the expansion of the quartz liquidus surface relative to the enstatite surface.

45316 **Formation of pigeonite on the join hedenbergite-ferrosilite at 11.5 and 15 kbar: experiments and a solution model.** Lindsley, D.H. (State Univ. of New York, Stony Brook). *American Mineralogist;* **66**: No. 11-12, 1175-1182(Nov-Dec 1981).

The three-pyroxene assemblage orthoferrosilite (OFs)-pigeonite (Pig)-hedenbergite (Hd/sub ss/) is stable on the $CaFeSi_2O_6$-$Fe_2Si_2O_6$ join at pressures above 11.5 kbar and below approximately 20 kbar. It is found at 825 +/- 10°C (11.5 kbar) and at 855 +/- 10°C (15 kbar). At lower pressures the low-Ca pyroxenes decompose to Hd/sub ss/ + Fayalite + Quartz while at and above 20 kbar the Hd/sub ss/ + Pig pair is replaced by a single clinopyroxene (Cpx). Under the assumption that (a) Pig has the C2/c space group at elevated temperatures and (b) Ca enters only the M2 site of Cpx, the Cpx solution can be described by an asymmetric Margules model: G/sup XS/ = [(20.697 - 0.00235P)X/sub CFs/ + (16.941 + 0.00592P)X/sub Hd/]X/sub Hd//X/sub CFs/, where units are kJ and kbar, and X/sub CFs/ and X/sub Hd/ are the mole fractions of $Fe_2Si_2O_6$ and of $CaFeSi_2O_6$ in Cpx. The Gibbs free energy for the reaction OFs = CFs (C2/c) is given by ΔG_1 = +1.843 - 0.001676T(Kelvin) + 0.03686P kJ. The Opx solution is assumed to be symmetric, with W/sub G/ = 15 kJ.

45317 **Heat capacities of the alkali feldspars between 350 and 1000 K from differential scanning calorimetry, the thermodynamic functions of the alkali feldspars from 298.15 to 1400 K, and the reaction quartz + jadeite = analbite.** Hemingway, B.S.; Krupka, K.M.; Robie, R.A. (Geological Survey, Reston, VA). *American Mineralogist;* **66**: No. 11-12, 1202-1215(Nov-Dec 1981).

The heat capacities, C/sub p/° of low albite, analbite, microcline, and high sanidine have been measured between 350 and 1000 K by differential scanning calorimetry. Evaluation of the results of several phase equilibrium studies of the reaction quartz + jadeite = analbite yields -3029.870 +/- 4.200 and -2851.300 +/- 4.200 kJ/mol for the enthalpy and Gibbs free energy of formation, respectively, of jadeite at 298.15 K and 1 bar. The enthalpy of the low albite-analbite transition determined from calorimetry using Amelia albite for low albite underestimates the magnitude of the enthalpy of the transition because Amelia albite is partially disordered (e.g., Holm and Kleppa, 1968).

5804 Geochemistry

REFER ALSO TO CITATION(S) 43861

45318 **(USGS-OFR—84-634) Analytical results of stream-sediment and nonmagnetic heavy-mineral-concentrate samples with sample locality map from portions of the Challis 1° x 2° quadrangle, Idaho.** McDanal, S.K.; Cooley, E.F.; Callahan, J.E. (Geological Survey, Reston, VA (USA)). 1984. 401p. US Geological Survey, Box 25425, Lakewood, CO 80225. File Number TI85901661.

This report presents the results of a geochemical survey of the Challis 1° x 2° quadrangle, Idaho. The Challis 1° x 2° quadrangle comprises about 7000 mi^2 (18,000 km^2) in the center of Idaho, and lies about 50 mi (80 km) northeast of Boise, Idaho. We collected samples at 2516 sites. At most sites, we collected both a stream-sediment sample and a heavy-mineral concentrate. Where suitable outcrop was available, we collected rock samples, and where water was available, we collected water samples. We analyzed 2516 stream-sediment samples, 2354 heavy-mineral-concentrate samples, and approximately 1300 water samples, for a sampling density of about 1 sample per 2.9 mi^2 for the stream sediment and heavy-mineral concentrate.

45319 **Devolatilization equilibria in H_2O-CO_2 and H_2O-CO_2-NaCl fluids: an experimental and thermodynamic evaluation at elevated pressures and temperatures.** Jacobs, G.K.; Kerrick, D.M. (Pennsylvania State Univ., University Park). *American Mineralogist;* **66**: No. 11-12, 1135-1153(Nov-Dec 1981).

Experimental equilibrium brackets have been obtained in H_2O-CO_2 and H_2O-CO_2-NaCl fluids for several decarbonation equilibria. Using available thermodynamic data and activities for H_2O and CO_2 calculated from the modified hard-sphere Redlich-Kwong (HSMRK) equation of Kerrick and Jacobs (1981), thermodynamic extrapolations in P-T-X/sub CO_2/ space of devolatilization equilibria yield close agreement with the experimental equilibrium brackets, implying that the experimental and thermodynamic data are internally consistent, and that the activities of H_2O and CO_2 predicted by the HSMRK equation of Kerrick and Jacobs (1981) are quite reasonable. The significance of assuming ideal vs. non-ideal mixing

of H_2O and CO_2 for the calculation of T-X/sub CO_2/ topologies is demonstrated for a portion of the system $CaO-Al_2O_3-SiO_2-H_2O-CO_2$. Experiments in H_2O-CO_2-NaCl mixtures at P=6 kbar show that, compared to binary H_2O-CO_2 fluids, the presence of small (5-10 wt.%) amounts of NaCl in the fluid phase significantly increase the activity of CO_2 for H_2O-rich compositions. At 2 kbar, however, little difference in the activity of CO_2 in H_2O-CO_2-NaCl vs. H_2O-CO_2 mixtures is implied by the experiments.

45320 **Join $CaAl_2Si_2O_8-H_2O$ (anorthite-water) at elevated pressures and temperatures.** Goldsmith, J.R. (Univ. of Chicago, IL). *American Mineralogist;* 66: No. 11-12, 1183-1188(Nov-Dec 1981).

A portion of the join anorthite-water in the quaternary system $CaO-Al_2O_3-SiO_2-H_2O$ has been reinvestigated in the range 550°-990°C, from 7 to 16 kbar. The reaction 4 anorthite + $H_2O \rightleftharpoons$ 2 zoisite + kyanite + quartz can be described by the equation P = -4590 + 20.4T, where P is in bars, T is in °C. The reaction is terminated at an invariant point at 725°C and 10.2 kbar, where melt first appears. The two reactions at higher temperatures and pressures are zoisite + kyanite + quartz + vapor $\rightleftharpoons$ liquid, and anorthite + vapor $\rightleftharpoons$ liquid, the latter delimiting the fields of anorthite + vapor and zoisite + kyanite + liquid + vapor. The incongruent melting of anorthite + water, beginning at 725°C, is significantly lower than earlier reported, and is unusual in that the solid assemblage anorthite + vapor lies on the high-temperature side of the boundary.

5805 Oceanography

45321 **(LA-UR—85-2412) Three-dimensional modeling of tsunami waves.** Mader, C.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-8508112—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015724.

From Tsunami symposium; Victoria, Canada (6 Aug 1985).

Two- and three-dimensional, time-dependent, nonlinear, incompressible, viscous flow calculations of realistic models of tsunami wave formation and run up have been performed using the Los Alamos-developed SOLA-3D code. The results of the SOLA calculations are compared with shallow-water, long-wave calculations for the same problems using the SWAN code. Tsunami wave formation by a continental slope subsidence has been examined using the two numerical models. The SOLA waves were slower than the SWAN waves and the interaction with the shoreline was more complicated for the SOLA waves. In the SOLA calculation, the first wave was generated by the cavity being filled along the shoreline close to the source of motion. The second wave was generated by the cavity being filled from the deep water end. The two waves interacted along the shoreline resulting in the second wave being the largest wave with a velocity greater than the first wave. The second wave overtook the first wave at later times and greater distances from the source. In the SWAN calculation, the second wave was smaller than the first wave. 6 refs.

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45322 **(DOE/ER—0191/2) Programs of the Office of Energy Research.** (USDOE Office of Energy Research, Washington, DC). Jul 1985. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017594.

The purpose of this research has been to support the energy technology development programs by providing insight into fundamental science and associated phenomena and developing new or advanced concepts and techniques. Today, this responsibility rests with the Office of Energy Research (ER), DOE, whose present programs have their origins in pioneering energy-related research which was initiated nearly 40 years ago. The Director, Office of Energy Research, also acts as the chief scientist and scientific advisor to the Secretary of Energy for the entire spectrum of energy research and development (R and D) programs of the Department. ER programs include several thousand individual projects and hundreds of laboratories, universities, and other research facilities throughout the United States. The current organization of ER is shown. The budgets for the various ER programs for the last two fiscal years are shown. In the following pages, each of these programs and activities are described briefly for the information of the scientific community and the public at large.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 45558, 45565, 45701

45323 **(AD-A—154967/4/XAB) Solar cycle variation of ephemeral regions. Final report, 1 November 1983-1 November 1984.** Harvey, K.L. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). 1 Dec 1984. 37p. NTIS, PC A03/MF A01.

Ephemeral active regions (ER) were identified and counted for selected periods from 1970 to mid-1984 using the daily, full-disk photospheric magnetograms taken by the National Solar Observatory. The number of ephemeral regions varies nearly in phase with the solar cycle. At solar minimum, ER are distributed almost uniformly in latitude; by solar maximum, peaks in the latitude distribution are observed in the sunspot zones and in higher latitude bands. In the quiet sun, 37% of the He I lambda 10830 dark points, used as a proxy for x-ray bright points (XBP), are associated with ER; 63% overlie bipoles that appear to be the chance encounter of opposite polarity network. The percentages are somewhat different in coronal holes; 21% of the dark points in He I are associated with ephemeral regions and 79% with bipoles that apparently result from chance encounters of flux. The dark points observed in the quiet sun and in coronal holes, vary anti-correlated with the solar cycle. Little relations was found between the areal density of He I dark points and ephemeral regions within the boundaries of coronal holes and parameters of the high-speed solar-wind streams associated with coronal holes. This study suggests that (1) ephemeral regions are not small active regions and that they may be primarily surface phenomena, possibly resulting from convection interacting with sub-photospheric fields, and (2) He I dark points, and therefore, XBP, are more often associated with the encounter of existing opposite polarity network flux, the occurrence of which is related to the amount of mixed-polarity areas which varies inversely with the solar cycle.

45324 **(CEA-CONF—7432) Some clues for the iron origin in galaxy clusters.** Rothenflug, R.; Arnaud, M.; Boulade, O.; Vigroux, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1984. 4p. (CONF-8406257—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752049.

From 84. x-ray astronomy congress; Bologna, Italy (26 Jun 1984).

In galaxy clusters, the mass in iron can be considered as directly proportional to the mass in gas. We establised that the mass in gas is linked to the total cluster luminosity in visible matter as Msub(G) is proportional to Lsub(opt)sup(1.6). On the other side, the gas mass seems proportional to the virial mass. We propose that this virial mass is made of star and/or star remnants which produced the iron in the past. The implications of this hypothesis is examined in terms of chemical evolution model of a mass of gas.

45325 **(FNAL/C—85/99-A) High energy neutrinos from Cyg X-3.** Walker, T.P.; Kolb, E.W.; Turner, M.S. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013219.

Assuming that the UHE air showers from Cyg X-3 are produced by photons, we calculate the expected neutrino emission from a model which produces the γ-rays in the atmosphere of the Cyg X-3 companion. We discuss the possibility of detecting such neutrinos in underground detectors and the constraints that such a signal places on the use of this model in other particle production scenarios. 16 refs., 5 figs.

45326 (FRNC-TH—1818) Interstellar origin atomic hydrogen in the solar system: modelling and application to analysis of Lyman alpha result (intensity and line profile) from Prognoz 5 and 6 satellites. Lallement, R. (Paris-6 Univ., 75 (France)). Oct 1983. 213p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751179.

Interstellar gas interaction with solar environment allows to deduce intensity distribution and spectral distribution and spectral profiles of Lyman-alpha and He lines. From comparison of these computed intensities and line profiles with the measurements, the gas state before the interaction with sun is hoped to be found. The construction of such a modelling, for neutral hydrogen, and applied to Lyman-alpha results obtained by sovietic satellites Prognoz 5 and 6, is presented here in this thesis. The method used to distinguish the two contributions to detected Lyman alpha emission: terrestrial and interplanetary contribution. Then hypothesis used in the model construction of the neutral hydrogen interaction with solar system are discussed and the model is presented. A test series of model sensitiveness to different parameters is presented particularly about the absorption cell. Then the comparison results between model and experimental data corrected from terrestrial contamination, always concerning hydrogen cell. A discussion on results is presented for concluding.

45327 (INIS-mf—9744) Radio structure in quasars. Barthel, P.D. (Rijksuniversiteit Leiden (Netherlands)). 13 Sep 1984. 184p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85781545.

Includes Dutch summary; includes previously published material; 333 refs.; 48 figs.; 21 tabs.

In this thesis, observational attention is given to the extended extragalactic radio sources associated with quasars. The isolated compact radio sources, often identified with quasars, are only included in the discussions. Three aspects of the radio structure in quasars and their cosmic evolution are considered: a study of the parsec scale morphology in quasar cores, in relation to the extended morphologies; an investigation of possible epoch dependent hotspot properties as well as a more detailed investigation of this fine scale structure; a VLA project was carried out to obtain morphological information on scales of 0.5 arcsec on high redshift quasars and to investigate possible epoch dependent morphological properties. MERLIN observations at 0.1 arcsec resolution to supplement the VLA data were initiated.

45328 (INIS-mf—9752) Broad line regions in Seyfert-1 galaxies. High resolution spectroscopy and multicomponent kinematical models. Groningen, E. van. (Rijksuniversiteit Leiden (Netherlands)). 29 Nov 1984. 156p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781546.

Includes Dutch summary; 300 refs.; 50 figs.; 16 tabs.

To reproduce observed emission profiles of Seyfert galaxies, rotation in an accretion disk has been proposed. In this thesis, the profiles emitted by such an accretion disk are investigated. Detailed comparison with the observed profiles yields that a considerable fraction can be fitted with a power-law function, as predicted by the model. The author analyzes a series of high quality spectra of Seyfert galaxies, obtained with the 2.5m telescope at Las Campanas. He presents detailed analyses of two objects: Mkn335 and Akn120. In both cases, strong evidence is presented for the presence of two separate broad line zones. These zones are identified with an accretion disk and an outflowing wind. The disk contains gas with very high densities and emits predominantly the lower ionization lines. He reports on the discovery of very broad wings beneath the strong forbidden line 5007.

45329 (LA-UR—85-2457) Upper limits to the masses of objects in the solar comet cloud. Hills, J.G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-8506174—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015713.

From 2. asteroids, comets, and meteors symposium; Uppsala, Sweden (3 Jun 1985).

The lack of a large steady stream of long-period comets with semi-major axes less than 2 x 10^4 AU rules out the sun having a companion more massive than about 0.01 M/sub solar/ with a semi-major axis less than about 1 x 10^4 AU. Any companion with a semi-major axis between 1 x 10^4 AU and 5 x 10^4 AU has more than a 50% probability of having entered the planetary system during the lifetime of the Solar System. The lack of apparent damage to the planetary system rules out any companion more massive than about 0.02 M/sub solar/ with a semi-major axis less than about 5 x 10^4 AU.

45330 (LAPP-TH—85) Constraints on a system of two neutral fermions from cosmology. Binetruy, P.; Girardi, G.; Salati, P. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jul 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752050.

Using the standard model of cosmology we study the evolution of the population of a coupled system of two neutral fermions in which the lighter one is stable. During the expansion their population can be frozen at a certain level which makes them contribute to the mass density of the universe. The details of the freezing depend crucially on the couplings and on the masses of these two fermions, so that, comparison with the measured mass density in the universe gives constraints on the parameters of the physical system we examine. We discuss in detail different configurations for the couplings among these fermions; in particular in the case of large mixing we obtain restrictive bounds on both masses. Our study is relevant to supersymmetric grand unified models which predict the occurence of light interacting neutral fermions, particularly Higgsinos.

45331 (LAPP-TH—99) Recombination of the primeval plasma and light-inos. Salati, P.; Wallet, J.C. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Mar 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752044.

The recombination of neutral hydrogen in the early Universe is reinvestigated taking into account light neutral fermions, stable or radiatively unstable. When these fermions are stable, their main effect is to increase the expansion rate of the Universe, and to increase the fossilized ionization xsub(e) of matter Big Bang nucleosynthesis provides density constraints on the baryonic components and if we assume that the Universe is closed with light neutral fermions, we can set limits upon xsub(e): 4 10^{-4} < xsub(e) < 2 10^{-3} instead of the previous baryon-dominant Universe result: 3 10^{-5} < xsub(e) < 3 10^{-4}. If the light neutral fermions decay radiatively, the emitted photon is in the UV-range and reionizes the neutral matter. We point out that matter can be completely reionized at a redshift Z approximately 100 for radiative lifetimes in the range 10^{20} - 10^{24} seconds. Supersymmetry provides us with such a light "ino". The reaction photino → photon + gravitino exhibits the good relation between the photino-lifetime and the ionizing photon energy.

45332 (PB—85-202927) Progress report on the analysis of long exposure SWP high-resolution spectra of cool stars. Final report. Linsky, J.L.; Ayres, T.R.; Brown, A.; Carpenter, K.; Jordan, C. (National Bureau of Standards, Boulder, CO (USA). Quantum Physics Div.). 1984. 5p. Proceedings of Future of Ultraviolet Astronomy Based on Six Years of IUE Research, Greenbelt, MD., April 3-5, 1984, NASA Conference Publication 2349, p445-449 1984.

During the last few years the authors have obtained very-long-exposure, high-dispersion SWP spectra of many stars located throughout the cool half of the HR diagram. These 12-21 hour exposures were obtained by combining NASA and Vilspa shifts so as to obtain the longest possible exposures at times of low background. Included are dwarf stars of spectral type GO V-M2 V, G9.5 III-M5 II giants, G2 Ib-M2 Iab supergiants, a number of RS CVn-type systems, and Barium stars. Given the importance of this data set and the many questions that it can answer with appropriate data reduction and extensive modeling efforts, the authors summarize briefly what has and is being done with these data.

45333 **(SAND—85-1521C) Coded aperture imaging system optimized for hard x-ray and gamma ray astronomy.** Gehrels, N.; Cline, T.L.; Huters, A.F.; Leventhal, M.; MacCallum, C.J.; Reber, J.D.; Stang, P.D.; Teegarden, B.J.; Tueller, J. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center; Bell Labs., Murray Hill, NJ (USA); Sandia National Labs., Albuquerque, NM (USA); State Univ. of New York, Geneseo (USA)). 1985. Contract AC04-76DP00789. 5p. (CONF-850883—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016938.

From 19. international cosmic ray conference; La Jolla, CA, USA (11 Aug 1985).

A coded aperture imaging system has been designed for the Gamma-Ray Imaging Spectrometer (GRIS). The system is optimized for imaging 511-keV positron-annihilation photons. For a galactic center 511-keV source strength of 10^{-3} $cm^{-2}s^{-1}$, the source location accuracy is expected to be +-0.2°.

45334 **(SI—84-01) News from cosmic rays at high energies.** Grupen, K. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Abt. fuer Physik). 1984. 78p. Siegen Univ. (Gesamthochschule) (Germany, F.R.). Abt. fuer Physik.

Basic data about primary cosmic rays, cosmic rays at ground level and underground are presented. The experimental evidence for the discovery of a point source (Cygnus X3) emitting extremely energetic photons (>1000 TeV) is described and discussed. Experimental results from emulsion chambers at mountain altitudes or in balloons and from the study of extensive air showers are reported and compared to accelerator data. The status of Kolar events and anomalons is reviewed.

45335 **(UCRL—92972) Theoretical models for Type I and Type II supernova.** Woosley, S.E.; Weaver, T.A. (California Univ., Santa Cruz (USA). Lick Observatory; Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48. 28p. (CONF-850375—19). NTIS, PC A03/MF A01; GPO Dep. File Number DE85016288.

From 20. Recontre de Moriond; Les Arcs, France (10 Mar 1985).

Recent theoretical progress in understanding the origin and nature of Type I and Type II supernovae is discussed. New Type II presupernova models characterized by a variety of iron core masses at the time of collapse are presented and the sensitivity to the reaction rate $^{12}C(\alpha,\gamma)^{16}O$ explained. Stars heavier than about 20 M/sub solar/ must explode by a "delayed" mechanism not directly related to the hydrodynamical core bounce and a subset is likely to leave black hole remnants. The isotopic nucleosynthesis expected from these massive stellar explosions is in striking agreement with the sun. Type I supernovae result when an accreting white dwarf undergoes a thermonuclear explosion. The critical role of the velocity of the deflagration front in determining the light curve, spectrum, and, especially, isotopic nucleosynthesis in these models is explored. 76 refs., 8 figs.

45336 **Production and detection of high-energy neutrinos from Cygnus X-3.** Kolb, E.W.; Turner, M.S.; Walker, T.P. (NASA/Fermilab Astrophysics Center, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60810). *Physical Review [Section] D: Particles and Fields;* **32**: No. 5, 1145-1151(1 Sep 1985).

Cygnus X-3 is a potent source of high-energy γ rays, with energies up to 10^4 TeV. In the context of a model where these γ rays are produced by the collision of a high-energy proton beam with matter we calculate the flux, spectrum, and "light curve" of the neutrinos produced. Neutrinos with energies of 3—100 TeV may be detectable in large, underground detectors by the muons they produce in the surrounding rock.

45337 **Big bang photosynthesis and pregalactic nucleosynthesis of light elements.** Audouze, J.; Lindley, D.; Silk, J. (Institut d'Astrophysique, Paris; and Laboratoire Rene Bernas, Orsay, France). *Astrophysical Journal, Letters to the Editor;* **293**: No. 2, L53-L58(15 Jun 1985).

Two nonstandard scenarios for pregalactic synthesis of the light elements (^2H, ^3He, ^4He, and ^7Li) are developed. Big bang photosynthesis occurs if energetic photons, produced by the decay of massive neutrinos or gravitinos, partially photodisintegrate ^4He (formed in the standard hot big bang) to produce ^2H and ^3He. In this case, primordial nucleosynthesis no longer constrains the baryon density of the universe, or the number of neutrino species. Alternatively, one may dispense partially or completely with the hot big bang and produce the light elements by bombardment of primordial gas, provided that ^4He is synthesized by a later generation of massive stars.

45338 **Proper solar wind power estimation and planetary radiometric efficiencies; and reply.** Baker, D.N.; Bargatze, L.F.; Desch, M.D.; Kaiser, M.L. (Los Alamos National Lab., NM). *Nature (London);* **314**: No. 6013, 755-756(25 Apr 1985).

The paper discusses the work of M.D. Desch and M.L. Kaiser [Nature 310, 755-757(1984)], concerning proper solar wind power estimation and planetary radiometric efficiencies. The methods, assumptions and conclusions of the paper are criticised by the authors, D.N. Baker and L.F. Bargatze. Answers to the criticisms, by Desch and Kaiser are reported.

45339 **Cosmological production of Kaluza-Klein monopoles.** Harvey, J.A. (Princeton Univ., NJ (USA). Dept. of Physics); Kolb, E.W. (Fermi National Accelerator Lab., Batavia, IL (USA). Theoretical Astrophysics); Perry, M.J. (Princeton Univ., NJ (USA). Dept. of Physics; Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). *Physics Letters, [Section] B;* **149**: No. 6, 465-469(27 Dec 1984).

The cosmological production of Kaluza-Klein monopoles is discussed. The present monopole-to-entropy ratio is calculated in some simple models with the conclusion that this ratio is unacceptably large unless additional mechanisms for entropy production or monopole annihilation are present.

45340 **Cooling pancakes.** Bond, J.R. (Cambridge Univ. (UK). Inst. of Astronomy; Stanford Univ., CA (USA). Inst. of Theoretical Physics); Centrella, J. (Illinois Univ., Urbana (USA). Dept. of Astronomy); Szalay, A.S. (California Univ., Berkeley (USA). Dept. of Astronomy; Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary)); Wilson, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Monthly Notices of the Royal Astronomical Society;* **210**: No. 3, 515-545(1 Oct 1984).

In theories of galaxy formation with a damping cut-off in the density fluctuation spectrum, the first non-linear structures to form are Zeldovich pancakes in which dissipation separates gas from any collisionless dark matter then present. One-dimensional numerical simulations of the collapse, shock heating, and subsequent thermal evolution of pancakes are described. Neutrinos (or any other cool collisionless particles) are followed by direct N-body methods and the gas by Eulerian hydrodynamics with conduction as well as cooling included. It is found that the pressure is relatively uniform within the shocked region and approximately equals the instantaneous ram pressure acting at the shock front. An analytic theory based upon this result accurately describes the numerical calculations.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 45005, 45060, 45071, 45338, 45777

45341 **(FRNC-TH—1626) Experimental study of electronic electrostatic waves detected in the terrestrial magnetosphere by the satellite GEOS 2.** Canu, P. (Paris-6 Univ., 75 (France)). Sep 1982. 163p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE85751186.

After reviewing the general characteristics of electrostator waves a brief resume is given of the observations made up to the present moment. The GEOS satellite and the "wave" experiment are described, as well as the method and results of the statistical study of the strong electrostatic wave observed. Creating mechanisms of diffuse auroras are discussed. In a later chapter a new

method of using the relaxation probe is presented as well as the results it gives on the mode of propagation of waves in the neighbourhood of the FUH frequency.

45342 (FRNC-TH—1768) Operation of a quadripole probe on magnetospheric satellite (GEOS experiment). Contribution to cold plasma behaviour study near equatorial plasma pause. Decreau-Prior, P. (Orleans Univ., 45 (France)). Jun 1983. 324p. (In French). NTIS (US Sales Only), PC A14/MF A01. File Number DE85751178.

This thesis is concerned with the exploitation of GEOS Satellite RF quadripole probe measurements, GEOS satellites have explored magnetosphere on the geostationary orbit and around it. Results a low to qualify the instrument in magnetospheric plasma (previously, it had been used only in ionosphere). Furthermore existence, outside the outer plasmasphere, of a cold population (from 0,4 to 8 eV) with medium density (from 2 to 50 particles cm^{-3}) is shown. This population had been ignored until then, by in situ particle measure experiment. So, new perspectives on coupling nature of the explored region with ionosphere, and with plasma sheet, more particularly because the temperature measured at the equator is on an average, clearly higher than in high ionosphere the principal source of magnetospheric cold plasma.

45343 (FRNC-TH—1922) Very low frequency valuation of a modulated beam of electrons: an application to the ARAKS experiment. Ahmadi, L. (Paris-6 Univ., 75 (France)). Dec 1982. 113p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752043.

The purpose of the ARAKS experiments was to study the effects due to the injection of energy electrons into the aurora zone. Here we analyse the TBF (2, 4 and 6 kHz) signals observed on the basis of interpretations in a closed or radiated field. We show that these signals are of an electromagnetic nature below fsub(HB) = 5 kHz and electrostatic above that figure, that they are correlated with the functioning of the electron gun and independent of the electrons' angle of attack. They propagate in the electronic hissing mode. At frequencies below fsub(HB), the main contribution comes from the close field, whereas it comes from the radiated field for f greater than fsub(HB).

45344 (TRITA-EPP—84-03) Model for the propagation of the westward traveling surge. Rothwell, P.L.; Silevitch, M.B.; Block, L.P. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics). May 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701867.

A unified model is developed for the propagation of the Westward Traveling Surge (WTS) which can explain the diversity in the observed surge characteristics. We start with the Inhester-Baumjohann model for the surge region which implicitly includes both the Hall and Pedersen currents. It is found that precipitating electrons at the conductivity gradient modify the gradient, causing it to propagate as a wave front. The velocity of propagation is directly dependent on the ionization efficiency of the precipitating electrons and, increases dramatically when they become more energetic during substorm onsets. The direction of the surge motion depends on the presence of polarization charges on the poleward surge boundary. This is related to the efficiency with which the poleward ionospheric currents are closed off into the magnetosphere by the field-aligned currents. Inclusion of the electron-ion recombination rate modifies the surge propagation velocity and leads to explicit expressions for the conductivity profile. Sufficient precipitation current is required to overcome electron-ion recombination in order for the surge to expand. Whem the precipitating current is less than this threshold the WTS retreats. Therefore, the model describes the ionospheric response to both the expansion and recovery phases of the magnetic substorm.

45345 (TRITA-EPP—84-05) Rocket and satellite observations of electric fields and ion convection in the dayside auroral ionosphere. Marklund, G.; Heelis, R.A. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics). Jun 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701868.

Electric field observations from two high-altitude rocket flights in the polar cusp have been combined with satellite observations of ion drifts to infer details of the electric field and convection pattern of the dayside auroral ionosphere. A region of shear flow reversal can be inferred from the electric field observations on one flight near 15.30 MLT 20 minutes after the Dynamics Explorer 2 satellite crossed through the same region. The drift patterns observed by the two spacecrafts were very similar although shifted by 0.5 degrees, a shift which is expected from the observed change in the interplanetary magnetic field (IMF) B(sub)Z component during this time. A region of rotational flow reversal was covered by the other flight shortly after magnetic noon, at the same time the DE-2 satellite travelled along roughly the dawn-dusk meridian. By joining points of equal potential, integrated from the two datasets and assuming the reversal boundary to be an equipotential, the instantaneous convection pattern could be drawn showing crescent-shaped convection contours in the dusk cell and more circular shaped contours in the dawn cell.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 44596, 44653, 44682, 44987, 45030, 45030, 45407, 45726, 45727, 45729, 45730, 45731, 45732, 45733, 45734, 45742, 45764

45346 (CNRS-CPT—84-P-1616) Relation between the (N) and (N-1) electrons atomic ground state. Briet, P. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). May 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751168.

The relation between the ground state of an N and (N-1) electrons atomic system are studied. We show that in some directions of the configuration space, the ratio of the N electrons atomic ground state to the one particle density is asymptotically equivalent to the (N-1) electrons atomic ground state.

45347 (CNRS-CPT—84-P-1625) Phase in the Aharonov-Bohm experiment. Horvathy, P.A. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jun 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751145.

The phase of the wave function scattered by an Aharonov-Bohm solenoid containing the quantized flux (h/e).n where n is an integer is shown to be (-1)sup(n) times that of the free one. A two-solenoid experiment is proposed to observe the difference between the cases when n is even or odd.

45348 (CONF-840788—4) Electron impact ionization of N^{4+} and N^{5+}. Defrance, P.; Chantrenne, S.; Brouillard, F.; Rachafi, S.; Belic, D.; Jureta, J.; Gregory, D. (Oak Ridge National Lab., TN (USA); Louvain Univ., Louvain-la-Neuve (Belgium). Inst. de Physique; Belgrade Univ. (Yugoslavia). Inst. za Fiziku). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016359.

From International conference on the physics of highly ionized atoms; Oxford, UK (2 Jul 1984).

A new crossed beams apparatus for measuring absolute electron impact ionization cross-sections of multiply charged ions is described. First measurements are also reported which deal with N^{4+} and N^{5+}. The results are in good agreements with those previously obtained by the Oak Ridge group. For N^{5+} a non negligible signal is observed below the ground state ionization threshold. It is attributed to the presence of ions in metastable states. From the semi-empirical Lotz formula, the population of ions in those states is estimated to some 3%. 8 refs., 3 figs.

45349 (CONF-850979—2) Isotopic dependences of the dielectric strength of gases: new observations, classification, and possible origins. Christophorou, L.G.; Rodrigo, H.; Marode, E.; Bastien, F. (Oak Ridge National Lab., TN (USA); Ecole Superieure d'Electricite, 91 - Gif-sur-Yvette (France). Lab. de Physique des Decharges). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02. File Number DE85017077.

From 8. annual gas discharge conference; Oxford, UK (16 Sep 1985).

In this paper we report: (1) the finding that the CH_4/CD_4 nonuniform field behavior is polarity dependent (i.e., the V/sub s/ of CD_4 is lower than the V/sub s/ of CH_4 for negative polarity which is just the opposite of that observed for positive polarity); (2) discuss the origins of the observed isotope effects and predict new isotopic dependences of V/sub s/; and (3) report results on the V/sub s/ of H_2S and D_2S for negative polarity which confirm their predicted isotopic behavior.

45350 **(DOE/ER/13116—4) Correlated charge changing ion-atom collisions. Progress report, March 15, 1984-March 15, 1985.** Bernstein, E.M.; Tanis, J.A. (Western Michigan Univ., Kalamazoo (USA). Dept. of Physics). Apr 1985. Contract AC02-83ER13116. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017062.

Correlations between x-ray emission and projectile charge-changing events have been investigated for highly charged ions incident on gas targets under single collision conditions. Measurements were made for 100 to 360 MeV $_{20}$Ca/sup 16,17,18+/ + He, 15 to 200 MeV $_{16}S^{13+}$ + He, 100 to 370 MeV $_{20}$Ca/sup 12,16,17,18,19+/ + H_2, and 455 to 705 MeV $_{57}La^{40+}$ + H_2. Coincidences between electron capture and K x-ray emission for Ca/sup q+/ + H_2 and He, combined with previous measurements for 180 to 460 MeV $_{23}$V/sup 19,20,21+/ + He, demonstrate the existence and substantiate the theory of resonant transfer and excitation (RTE). Additional K-shell RTE studies include theoretical calculations of the cross sections for Li-like ions with $14 \leq Z \leq 26$ incident on He and Ne. The $_{57}La^{40+}$ + H_2 measurements provide evidence for L-shell RTE. For S^{12+} + He new evidence is obtained for nonresonant transfer and excitation, a two-step process in which uncorrelated electron capture and projectile excitation occur in a single encounter. Total electron capture cross sections for S^{13+} + He vary by about 10^8 over the energy range investigated and are in reasonable agreement with empirical values. Other studies of electron capture and loss include measurements of the charge-state dependence for V/sup q+/ + He (q = 18 to 23) at 8.55 MeV/amu.

45351 **(FRNC-TH—1564) Experimental study of the role of autoionizing states of H_2 (D_2) in the production of energetic protons (deuterons) by electron impact.** Landau, M. (Paris-6 Univ., 75 (France)). Jun 1982. 126p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751175.

The autoionizing state study seemed interesting to be taken up again in energy ranges corresponding to formation thresholds, a device well adapted to this range was available concerning electron measurements. Among other things, the overlapping autoionizing states have been displayed; proton kinetic energy distribution appropriate to each state at its formation threshold have been got. The whole of these results represents a proton (and D^+) production mechanism study contribution via autoionizing states. The theory used to describe autoionization cross-section calculations are recalled. Experimental results are presented, discussed, compared to experimental results and theoretical predictions.

45352 **(FRNC-TH—1766) Interpretation of duoplasmatron-type ion sources from a model of the discharge.** Lejeune, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1971. 198p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752051.

The performance improvement of these sources needs a precise knowledge of the emitting ionized medium, on which the whole of the properties depend. Ion production mechanisms have been studied in the discharge together with their transport towards the extraction hole. The source properties are described, in a new manner, as a function of the discharge modes. The discharge is characterized by the existence of a mode change, related to anode column neutral atom reduction in the anode column (arc starvation). The complementarity of probe measurements and the energy spectra analysis of the charges emitted by the anode enables measurement of the potential axial profile, to discover an electric energetic electron beam extracted from the cathodic plasma and to determine the electron density radial profile in the anode column. Result analysis allows to get a simple scheme of plasmas and laws controlling them in each of the important modes.

45353 **(FRNC-TH—1770) Experimental study of once ionized Helium Pα line shift. Plasma polarization effect.** Le Gall, P. (Orleans Univ., 45 (France)). Oct 1983. 134p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751180.

In a first time, an electrical device has been developped to obtain a plasma with a very wide electron density range (5.10^{16}-6.10^{17} electron/cm^3) in discharge tube. In a second time, accounting with local thermodynamic equilibrium criteria, plasma diagnostic methods have been studied: intensity ratio between the 587 A (HeI) line and the 4686 A (HeII) line to get the electron temperature; 4686 A line broadening for electron density. Displacement of the HeII Pα line has been measured statistically, with an 500 channel optical analyser. The displacement obtained is linear with electron density.

45354 **(GSI—85-1-Prepr.) Coupled state analysis of electron excitations in asymmetric collision systems.** Mehler, G.; Reus, T. de; Mueller, U.; Reinhardt, J.; Mueller, B.; Greiner, W.; Soff, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1985. 22p. (CONF-8411142—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751870.

From 2. international workshop on cross sections for fusion and other applications; College Station, TX, USA (8 Nov 1984).

A coupled channel formalism is presented, using relativistic basis states of the target atom. Screening effects are incorporated by means of an effective potential of Hartree-Fock-Slater type. Relativistic wave packets are employed for the description of the continuum. The impact parameter dependence of the K-hole production in p-Ag collisions is calculated, including quadrupole contributions of the projectile Coulomb potential. The results are compared with experimental data.

45355 (INIS-mf—9306, pp J4) **Pionic atoms from high-energy nuclear collisions.** Che Ming Ko (Texas A and M Univ., College Station (USA). Cyclotron Inst.; Texas A and M Univ., College Station (USA). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45356 (INIS-mf—9306, pp K6) **Nuclear muon capture by deuterons.** Cargnelli, M.; Breunlich, W.H.; Fuhrmann, H.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Petitjean, C. (Schweizerisches Inst. fuer Nuklearforschung, Villigen); Bertl, W.H. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mittelenergiephysik). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45357 (INIS-mf—9306, pp L5) **K^- and Σ^- atom studies with high-Z targets.** O'Brien, F.; Dodson, G.W.; Miller, J.P.; Roberts, B.L. (Boston Univ., MA (USA)); Eckhause, M.; Guss, P.P.; Hertzog, D.W.; Kane, J.R.; Phillips, W.C.; Vulcan, W.F. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45358 (INIS-mf—9306, pp L6) **Anomalous strong interaction in pionic atoms of Mg and Al.** Achard van Enschut, J.F.M. d'; Eijk, C.W.E. van; Lourens, W. (Technische Hogeschool Delft (Netherlands). Dept. of Physics); Berkhout, J.B.R.; Hesselink, W.H.A.; Ketel, T.J.; Prins, T. (Vrije Univ., Amsterdam (Netherlands)); Duinker, W.; Koch, J.H.; Konijn, J. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45359 (INIS-mf—9306, pp L7) **Pionic and muonic X-ray studies of ^{237}Np.** Achard van Enschut, J.F.M. d' (Technische Hogeschool Delft (Netherlands). Dept. of Physics); David, P.; Hartfiel, J.; Janssen, H.; Mayer-Kuckuk, T.; Mutius, R. von (Bonn Univ. (Germany, F.R.). Inst. fuer Strahlen- und Kernphysik); Duinker, W.; Konijn, J.; Laat, C.T.A.M. de (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)); Gugler, C. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45360 (INIS-mf—9306, pp L8) **Pionic 2P-1S X-ray from 23Na.** Britton, D.I.; Beer, G.A.; Marshall, G.M.; Mason, G.R.; Numao, T.; Olin, A. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Victoria Univ., British Columbia (Canada)); Forsman, J.W.; Macdonald, J.A.; Esbroek, P. van (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45361 (INIS-mf—9306, pp L9) **Pionic 4F-3D X-rays from ^{206}Pb and ^{209}Bi.** Olin, A.; Beer, G.A.; Britton, D.I.; Marshall, G.M.; Mason, G.R.; Numao, T. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Victoria Univ., British Columbia (Canada)); Forsman, J.W.; Macdonald, J.A.; Esbroek, P. van (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45362 (INIS-mf—9306, pp L11) **Precision measurements of 3D-2P pionic X-rays in low-Z atoms.** Beer, W.; Bos, K.; Chambrier, G. de; Giovanetti, K.; Goudsmit, P.F.A.; Leisi, H.J.; Strassner, G.; Vacchi, A. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mittelenergiephysik); Boer, F.W.N. de; Jeckelmann, B. (Fribourg Univ. (Switzerland). Inst. de Physique). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45363 (INIS-mf—9306, pp L12) **Precision measurement of the 2P-1S transition wave length in muonic ^{13}C.** Aas, B.; Beer, W.; Beltrami, I.; Goudsmit, P.F.A.; Leisi, H.J.; Ruckstuhl, W.; Strassner, G. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mittelenergiephysik); Baertschi, P. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)); Boer, F.W.N. de; Bos, K. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45364 (INIS-mf—9306, pp L14) **New evaluation of muonic X-ray energies in 208-lead.** Bergem, P.; Boschung, M.; Phan, T.Q.; Piller, G.; Rueetschi, A.; Schaller, L.A.; Schellenberg, L.; Schneuwly, H. (Fribourg Univ. (Switzerland). Inst. de Physique); Hoehn, M.V.; Shera, E.B. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45365 (INIS-mf—9306, pp L15) **Measurement of the Lamb shift in muonium.** Oram, C.J.; Bailey, J.M.; Schmor, P.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility); Fry, C.A.; Kiefl, R.F.; Warren, J.B. (British Columbia Univ., Vancouver (Canada)); Marshall, G.M.; Olin, A. (Victoria Univ., British Columbia (Canada)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45366 (INIS-mf—9306, pp L16) **Neutral muonic helium (3).** Arnold, K.P.; Gladisch, M.; Jacobs, W.; Krauth, M.; Mundinger, H.J.; Putlitz, G. zu; Orth, H.; Rosenkranz, J.; Schaefer, W. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Hughes, V.W. (Yale Univ., New Haven, CT (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45367 (INIS-mf—9306, pp L18) **Muonium Lamb shift.** Badertscher, A.; Hughes, V.W.; Lu, D.C.; Ritter, M.W.; Woodle, K.A. (Yale Univ., New Haven, CT (USA)); Gladisch, M.; Orth, H.; Putlitz, G. zu (Heidelberg Univ. (Germany, F.R.)); Eckhause, M.; Kane, J. (College of William and Mary, Williamsburg, VA (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45368 (INIS-mf—9306, pp L21) **Measurement of the lifetime and quenching rate of metastable 2S muonic helium ions.** Arb, H.P. von; Dittus, F.; Heeb, H.; Hofer, H.; Kottmann, F.; Niggli, S.; Schaeren, R.; Unternaehrer, J. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hochenergiephysik); Egelhof, P. (Basel Univ. (Switzerland). Inst. fuer Physik); Taqqu, D. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45369 (INIS-mf—9306, pp L22) **New experimental results on hyperfine transitions in muonic hydrogen isotopes.** Breunlich, W.H.; Cargnelli, M.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Janett, A.; Petitjean, C. (Schweizerisches Inst. fuer Nuklearforschung, Villigen); Sherman, R.H. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45370 (INIS-mf—9306, pp L27) **Kaonic hydrogen in momentum space.** Landau, R.H.; Cheng, B. (Oregon State Univ., Corvallis (USA). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45371 (INIS-mf—9306, pp L28) **CBM predictions for the anti KN interaction and kaonic hydrogen.** Barrett, R.C. (Surrey Univ., Guildford (UK)); Veit, E.A.; Jennings, B.K. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility); Thomas, A.W. (Adelaide Univ. (Australia). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45372 (INIS-mf—9306, pp L29) **Theoretical studies of kaonic hydrogen.** Law, J.; Turner, M.J.; Barrett, R.C. (Surrey Univ., Guildford (UK)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45373 (INIS-mf—9306, pp L33) **Anomalous widths in pionic atoms and the problem of S-wave repulsion.** Olivier, J.G.; Thies, M. (Vrije Univ., Amsterdam (Netherlands). Physics Dept.); Koch, J.H. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45374 (INIS-mf—9306, pp L35) **Application of the Faddeev-Hahn equations to the mesomolecular system calculation.** Gandyl, E.M.; Sultanov, R.A.; Zubarev, A.L. (Tashkentskij Gosudarstvennyj Univ. (USSR). Physics Dept.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45375 (INIS-mf—9306, pp L36) **Possible influence of the strong interaction on the mesomolecular system properties.** Gandyl, E.M.; Galimzyanov, R.M.; Zubarev, A.L. (Tashkentskij Gosudarstvennyj Univ. (USSR). Physics Dept.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45376 (INIS-mf—9306, pp L37) **High accuracy calculations of energy levels of exited states of ddμ- and dtμ-mesic molecules.** Gocheva, A.D.; Gusev, V.V.; Melezhik, V.S.; Ponomarev, L.I.; Puzynina, T.P.; Puzynin, I.V.; Vinitsky, S.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45377 (INIS-mf—9306, pp L39) **Relativistic corrections to the energy levels of ddμ and dtμ muonic molecules.** Bakalov, D.D. (Bylgarska Akademiya na Naukite, Sofia. Inst. po Yadrena Fizika i Yadrena Energetika); Melezhik, V.S.; Menshikov, L.I.; Vinitsky, S.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45378 (INIS-mf—9306, pp L19) **Muon transfer rate from hydrogen to argon.** Bergem, P.; Bienz, F.; Boschung, M.; Jacot-Guillarmod, R.; Piller, G.; Schaller, L.A.; Schellenberg, L.; Schneuwly, H.; Siradovic, D. (Fribourg Univ. (Switzerland). Inst. de Physique); Torelli, G. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45379 (INIS-mf—9306, pp L20) **Search for delayed photons from 2S-muonic He at 40 atmospheres.** Deitlicher, R.; Zehnder, A. (Schweizerisches Inst. fuer Nuklearforschung, Villigen); Eckhause, M.; Guss, P.P.; Joyce, D.; Kane, J.R.; Siegel, R.T.; Vulcan, W.F.; Welsh, R.E.; Whyley, R.J. (College of William and Mary, Williamsburg, VA (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45380 (INIS-mf—9306, pp L34) **Recent calculations of muon-catalyzed d-t fusion.** Leon, M. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45381 (INIS-mf—9306, pp L40) **Scattering cross sections of muonic hydrogen atoms on hydrogen isotope nuclei.** Melezhik, V.S.; Ponomarev, L.I. (Joint Inst. for Nuclear Research, Dubna (USSR)); Wozniak, J. (Institute of Nuclear Physics, Krakow (Poland)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45382 (INIS-mf—9306, pp N3) **Methods for measuring the muon capture ratio A(H/Z) in a H_2+Z gas mixture.** Schneuwly, H. (Fribourg Univ. (Switzerland). Inst. de Physique). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45383 (INIS-mf—9306, pp L26) **Simple exotic system: Radiative formation of the positronium.** Erdas, A.; Mezzorani, G.; Quarati, P. (Istituto Nazionale di Fisica Nucleare, Cagliari (Italy); Cagliari Univ. (Italy). Dipartimento di Scienze Fisiche). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45384 **(INIS-mf—9748) Theoretical aspects of the stabilization of atomic hydrogen.** Eijnde, J.P.H.W. van den. (Technische Hogeschool Eindhoven (Netherlands)). 13 Apr 1984. 136p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85781536.

Includes Dutch summary; 83 refs.; 26 figs.; 5 tabs.

This thesis describes a theoretical study of processes leading to recombination of hydrogen atoms into molecular form. A relaxation process, due to the transition among the lowest two hyperfine levels of atomic hydrogen, turns out to be of fundamental importance for the recombination rate. Models have been formulated to calculate the relaxation rate by means of quantum mechanical scattering theory. For processes in the bulk of the gas the results of an almost exact coupled-channels calculation have been compared with approximate models. In these models first-order approximations are applied, as well as approximations connected with the large distance of closest approach of the colliding hydrogen atoms. The assumptions turned out to be correct to the promille level, except for the so-called high-temperature limit.

45385 **(INIS-mf—9750) Study of interference effects in Na(3S,3P)-Ne, Ar scattering experiments at high angular resolution.** Berg, F.T.M. van den. (Rijksuniversiteit Utrecht (Netherlands)). 28 Jun 1984. 105p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781537.

Includes Dutch summary; 140 refs.; 23 figs.; 3 tables.

In this thesis the author presents measurements of differential cross sections for the scattering of Na-atoms in the ground-state and first excited-state by the rare gas atoms Ne and Ar. The scattering experiments were performed in a crossed-beam apparatus built and tested by van Deventer et al. The unique high angular-resolution (0.1°) of this beam-scattering apparatus permits us (i) to remove the discrepancies that still exist between the various $X^1\Sigma$- and $A^1\Pi$-potential curves for Na-Ar and Na-Ne reported up to now, (ii) to obtain detailed information on the $B^1\Sigma$-potentials for these systems and (iii) to demonstrate the necessity of taking into account the spin-uncoupling effects, in the interpretation of the experimental Na-Ne scattering patterns.

45386 (LA—10227-C-Vol.2, pp 346-357) **Introduction to electronic excitations.** Sinha, S.K. (Exxon Research and Engineering Co., Annandale, NJ). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Discussed briefly are some of the various techniques which may be used to study electronic excitations in condensed matter. Photoemission and neutron, electron and x-ray inelastic scattering are considered. Their various strengths and weaknesses are reviewed in rather general terms.

45387 (LA—10227-C-Vol.2, pp 378-383) **Inelastic electron scattering spectroscopy: a comparison of absorption and emission spectra.** Schnatterly, S.E. (Univ. of Virginia, Charlottesville). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The operation of a high energy inelastic scattering spectrometer is briefly described. Measured absorption and emission spectra are fit to parameters in recently described models for insulators. Implications for model validity are discussed.

45388 (LA—10227-C-Vol.2, pp 577-590) **Surface vibrational spectroscopy.** Erskine, J.L. (Univ. of Texas, Austin). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

A brief review of recent studies which combine measurements of surface vibrational energies with lattice dynamical calculations is presented. These results suggest that surface vibrational spectroscopy offers interesting prospects for use as a molecular-level probe of surface geometry, adsorbate bond distances and molecular orientations.

45389 (LA—10227-C-Vol.2, pp 358) **Heavy fermion solids and their superconductivity.** Varma, C.M. (AT and T Bell Labs., Murray Hill, NJ). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Rare earth and actinide materials exhibiting Fermi-liquid behavior with characteristic effective mass of a few hundred times the free electron mass have been extensively investigated in the past decade. Recent discovery of superconductivity in some of these materials has given added impetus to the field. The theoretical problems posed by these materials are very interesting and very difficult. The principal results that must be explained by a theory and the necessary physical ingredients of such a theory are discussed. These ingredients are the spin renormalization of a single localized f-resonance in a conduction band (the Kondo effect), and the ability of an electron in such a resonance to convert to a conduction electron if the resonance is not too far from the Fermi-level and the consequent formation of a heavy band despite huge bare electron-electron repulsions. The author argues that conventional singlet pairing to make a superconducting state is very unlikely in these materials but that the interactions favor a triplet superconducting state. In fact, experiments suggest this fascinating possibility.

45390 (LA—10227-C-Vol.2, pp 359-377) **Photoemission studies of mixed valent systems.** Parks, R.D.; Raaen, S.; den-Boer, M.L.; Williams, G.P. (Polytechnic Institute of New York, Brooklyn). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2). Contract AC02-81ER10862;AC02-76CH00016.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Photoemission spectroscopy has been used to study a number of aspects of the mixed valent state (corresponding to non-integral 4f occupation) in rare earth systems. Deep core photoemission (e.g., from 3d or 4d levels) allows the measurement of the 4f occupancy and surface valence shifts, and, as well, the indirect measurement of the effect of solid state environment on the energy of hybridization between 4f electrons and conduction electrons. 4f-Derived photoemission has been used to study surface valance and chemical shifts and to infer the nature of the mixed valent ground state. A combination of 4f-derived photoemission and add-electron spectroscopy provides a measurement of the rf Coulomb correlation energy, an important parameter in the mixed valent problem. A review of these approaches will be presented, with emphasis on Ce-based systems, whose behavior falls outside the usual description of 4f-unstable systems.

45391 (LA—10227-C-Vol.2, pp 548-558) **Internal vibrations in molecular crystals.** Howard, J. (Univ. of Durham, England). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Recent developments in the understanding of the relative intensities of INS bands (polycrystalline samples) are described together with the observation of a fundamental transition at ca 380 MeV (C-H stretching mode) uncontaminated by overtone or combination bands. Recent work (>100 MeV) on strongly hydrogen bonded complexes (CrOHO and $MFHF^-$), which have high energy modes exhibiting significant dispersion, is also discussed.

45392 (LA—10227-C-Vol.2, pp 559-576) **Localized vibrations of hydrogen in metals.** Richter, D. (Kernforschungsanlage Juelich GmbH, West Germany). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

New experimental results on local H-vibrations in transition metals are examined selecting three examples: 1) high resolution measurements of the fundamental vibrations of the H-isotopes are reviewed. In combination with the also observed higher harmonics they led to an evaluation of the anharmonic H-potential in Nb and Ta. Its knowledge is of particular importance in connection with

the fast H-diffusion mechanism in these metals. 2) Spectroscopic observations of H-trapping are surveyed. The measurements revealed detailed microscopic information, e.g. on the symmetry of the trapping sites and their degree of disturbance. Interstitial oxygen and nitrogen impurities as well as substitutional titanium in Nb were found to be strong traps which suppress the precipitation of hydride phases at low temperature, whereas Cr is a shallow trap which cannot prevent phase separation. 3) Recent results on the higher harmonics and the isotope shifts of the H-vibrations in PdH/sub x/ are discussed in view of the anomalous isotope effect of the superconducting transition temperature T/sub c/ in Pd-hydride. These measurements revealed an anharmonic but identical potential for H and D and show that anharmonicity and not an isotope dependent electronic environment causes the T/sub c/-anomaly in PdH(D).

45393 **(LA—10227-C-Vol.2, pp 479-492) (e,2e) reactions on atoms and molecules.** McCarthy, I.E. (Flinders Univ. of South Australia, Bedford Park). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

At high enough incident energy and for high enough momentum transfer an incident electron interacts with a single electron of a target atom or molecule, cleanly removing it and leaving the residual ion in one of its spectrum of quantum states. Under these conditions the dynamics of the reaction simply involves a two-electron collision, the target electron having a momentum given by the structure of the target and ion, and equal and opposite to the recoil momentum of the ion. Since two-electron collisions are well understood (Mott scattering) the reaction is the basis of the understanding of the energy and momentum structure of the target and ion known as electron momentum spectroscopy.

45394 **(LA-UR—85-2595) Gas cell neutralizers (Fundamental principles).** Fuehrer, B. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 38p. (CONF-8506150—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85015747.

From Neutralizer workshop; Upton, NY, USA (5 Jun 1985).

Neutralizing an ion-beam of the size and energy levels involved in the neutral-particle-beam program represents a considerable extension of the state-of-the-art of neutralizer technology. Many different mediums (e.g., solid, liquid, gas, plasma, photons) can be used to strip the hydrogen ion of its extra electron. A large, multidisciplinary R & D effort will no doubt be required to sort out all of the "pros and cons" of these various techniques. The purpose of this particular presentation is to discuss some basic configurations and fundamental principles of the gas type of neutralizer cell. Particular emphasis is placed on the "Gasdynamic Free-Jet" neutralizer since this configuration has the potential of being much shorter than other type of gas cells (in the beam direction) and it could operate in nearly a continuous mode (CW) if necessary. These were important considerations in the ATSU design which is discussed in some detail in the second presentation entitled "ATSU Point Design".

45395 **(LA-UR—85-2596) ATSU Point Design (gasdynamics).** Fuehrer, B. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 32p. (CONF-8506150—3). NTIS, PC A03/MF A01; GPO Dep. File Number DE85015746.

From Neutralizer workshop; Upton, NY, USA (5 Jun 1985).

In this presentation the basic principles outlined in the first talk "Gas Cell Neutralizers" will be applied to a problem of particular interest viz., the design of a "gasdynamic free-jet" neutralizer for the Los Alamos ATSU project. What will be presented here does not in any way represent the final gas neutralizer design for ATSU. Rather, the material presented herein should be viewed as simply a preliminary design intended to identify and gain insight into the more subtle issues that must be considered in designing this type of gas neutralizer.

45396 **(LBL—17827-Rev.) Effect of resonant microwave power on a PIG ion source. Revision.** Brown, I.G.; Galvin, J.E.; Gavin, B.F.; MacGill, R.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 5p. (CONF-850504—262-Rev.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016644.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

We have investigated the effect of applying microwave power at the electron cyclotron frequency on the characteristics of the ion beam extracted from a hot-cathode PIG ion source. No change was seen in the ion charge state distribution. A small but significant reduction in the beam noise level was seen, and it is possible that the technique may find application in situations where beam quiescence is important. 32 refs., 2 figs.

45397 **(LBL—19854) Vibrational predissociation spectroscopy of hydrogen cluster ions.** Okumura, M.; Yeh, L.I.; Lee, Y.T. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Chemistry). Jun 1985. Contract AC03-76SF00098. 11p. (CONF-850605—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016629.

From 7. international conference on laser spectroscopy; Maui, HI, USA (24 Jun 1985).

The first infrared spectra of protonated hydrogen clusters in the gas phase have been observed. Predissociation spectra were taken with a tandem mass spectrometer: mass selected hydrogen cluster ions were irradiated inside a rf ion trap by a tunable infrared laser, and the fragment ions created by photodissociation of the clusters were mass selected and detected. Spectra for each product channel were measured by counting fragment ions as a function of laser frequency. Low resolution spectra ($\Delta\nu = 10$ cm^{-1}) in the region from 3800 cm^{-1} to 4200 cm^{-1} were observed for the ions H_5^+, H_7^+ and H_9^+ at 3910 cm^{-1}, 3980 cm^{-1}, and 4020 cm^{-1} respectively. A band was also observed for H_5^+ at 3532 cm^{-1}. No rotational structure was resolved. The frequencies of the band maxima agree well with the frequencies predicted by previous ab initio calculations for the highest modes.

45398 **(PB—85-189355) Configuration interaction in multiphoton ionization. Final report.** Zoller, P.; Matthias, E.; Smith, S.J. (National Bureau of Standards, Boulder, CO (USA). Quantum Physics Div.). 1984. 9p. Proceedings of NAGO Summer School in Quantum Electrodynamics and Quantum Optics, Boulder, CO, May 26-June 8, 1983, p313-321 1984.

The application of multichannel quantum-defect theory (MQDT) to interpretation of recent photoelectron angular distribution measurements obtained in this laboratory by resonant multiphoton excitation and ionization of atomic barium, is discussed. The pronounced effect of a doubly excited (5d7d) state acting to perturb the singly excited 6snd Rydberg series makes these angular distributions and their interpretation particularly significant.

45399 **(SAND—85-0618C) Catastrophic planar dechanneling in strained-layer superlattices.** Chu, W.K.; Allen, W.R.; Ellison, J.A.; Picraux, S.T. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy; New Mexico Univ., Albuquerque (USA). Dept. of Mathematics; Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017160.

Recently a catastrophic dechanneling effect has been discovered to occur when the wavelength of a planar-channeled ion beam matches the layer period of a strained-layer superlattice (SLS). We report continuum model calculations of planar channeled trajectories in strained-layer superlattices to obtain the depth dependence of the dechanneling due to the SLS structure for various incident angles. The calculations are in good agreement with the dechanneling measurements. In addition, features of the dechanneling versus depth calculation are found to be quite sensitive to the continuum potential near the planes and these features are experimentally resolvable. This work not only provides for the measurement of lattice strain in superlattices, but also enhances our understanding of

planar channeling and suggests a new method for comparing the accuracy of various scattering potentials. 10 refs., 5 figs.

45400 **(SAND—85-1582C) Configurational diffusion in semidilute solutions.** Martin, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 5p. (CONF-850778—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017121.

From Polymer flow workshop; La Jolla, CA, USA (10 Jul 1985).

Dynamic light scattering measurements of the relaxation times of internal modes of single polymer chains in semidilute solution are reported for dilute high molecular weight polystyrene in a semidilute poly(vinylmethylether)/toluene host. Since PVME is index matched by toluene these light scattering measurements probe the dynamics of the isolated polystryene chains and are insensitive to the collective fluctuations of the PVME host. The principle result is that the Rayleigh linewidth scales like the third power of the momentum transfer regardless of the concentration of the semidilute polymer. This is in apparent contradiction to current theories of hydrodynamic screening in semidilute solutions, which predict a fourth power dependence for the linewidth. 9 refs., 4 figs.

45401 **(UCRL—92974) Condensed matter at high shock pressures.** Nellis, W.J.; Holmes, N.C.; Mitchell, A.C.; Radousky, H.B.; Hamilton, D. (Lawrence Livermore National Lab., CA (USA)). 12 Jul 1985. Contract W-7405-ENG-48. 14p. (CONF-850767—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016443.

From 15. international symposium on shock waves and shock tubes; Berkeley, CA, USA (29 Jul 1985).

Experimental techniques are described for shock waves in liquids: Hugoniot equation-of-state, shock temperature and emission spectroscopy, electrical conductivity, and Raman spectroscopy. Experimental data are reviewed and presented in terms of phenomena that occur at high densities and temperatures in shocked He, Ar, N_2, CO, SiO_2-aerogel, H_2O, and C_6H_6. The superconducting properties of Nb metal shocked to 100 GPa (1 Mbar) and recovered intact are discussed in terms of prospects for synthesizing novel, metastable materials. Ultrahigh pressure data for Cu is reviewed in the range 0.3 to 6TPa (3 to 60 Mbar). 56 refs., 9 figs., 1 tab.

45402 **Diode laser absorption spectroscopy of D_3O^+: Determination of the equilibrium structure and potential function of the oxonium ion.** Sears, T.J.; Bunker, P.R.; Davies, P.B.; Johnson, S.A.; Spirko, V. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **83**: No. 6, 2676-2685(15 Sep 1985).

High resolution measurements of the two components of the ν_2 (umbrella) fundamental mode of the fully deuterated oxonium ion (D_3O^+) are reported. The spectra were obtained by diode laser absorption in a plasma containing D_2 and D_2O. Analysis of the observed spectra yields precise estimates of the two band origins and molecular parameters describing the states involved. By combining these data with the available high resolution data for H_3O^+, using the nonrigid invertor Hamiltonian, we are able to determine the equilibrium structure and the vibrational potential function; also we predict the inversion spectrum of D_3O^+ and the $2\nu_2—\nu_2$ hot band spectra of H_3O^+ and D_3O^+.

45403 **Comment on "Shifts of hydrogen lines from electron collisions in dense plasmas".** Iglesias, C.A.; Boercker, D.B.; Lee, R.W. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **32**: No. 3, 1906-1907(Sep 1985).

It is shown that line-shift calculations for neutral hydrogen to second order in the atom-electron interaction are very dependent on the strong-collision cutoff procedure.

45404 **Spin dependence in superelastic electron scattering from Na(3P).** McClelland, J.J.; Kelley, M.H.; Celotta, R.J. (Radiation Physics Division, National Bureau of Standards, Gaithersburg, Maryland 20899). *Physical Review Letters;* **55**: No. 7, 688-691(12 Aug 1985).

Measurements are presented of spin asymmetries for superelastic scattering of 10-eV spin polarized electrons from the excited Na(3P/sub 3/2/) state created by linearly polarized laser optical pumping. Asymmetries as large as 16% are observed in scattering from a state which is not spin-polarized. Results are shown both as a function of scattering angle with fixed laser polarization direction, and as a function of the laser polarization direction at a fixed scattering angle.

45405 **Electron impact heated atomic hydrogen oven.** Glass, G.A.; Andersen, L.H.; Elston, S.B.; Engar, P.; Holmes, R.; Rozet, J.; Taylor, D.A.; Thoe, R.S.; Berry, S.D.; Breinig, M. (University of Tennessee and Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Review of Scientific Instruments;* **56**: No. 8, 1520-1525(Aug 1985). Contract AC05-84OR21400.

The design, construction, and performance of an electron impact heated hydrogen dissociation oven for use in producing an atomic hydrogen gas target for ion—atom collision experiments are described. This novel design utilizes an electron beam focused by a spherical lens system to heat the oven to temperatures in excess of 2400 K. High dissociation fractions are found with cell pressures $>$ or $=5$ mTorr. The compact design allows placement of an electron spectrometer close to the interaction region (length $\sim$ 1.5 cm), as well as direct measurement of the oven temperature by means of an optical pyrometer. The electron beam produces magnetic fields $\sim$ 40 mG $\sim$ 1 cm from the center of the interaction region. These low magnetic fields offer distinct advantages compared to low-voltage, high-current oven designs when observing relatively low-energy electrons ejected in ion—atom collisions.

45406 **Proton-transfer spectroscopy of 3-hydroxychromones. Extreme sensitivity to hydrogen-bonding perturbations.** McMorrow, D.; Kasha, M. (Florida State Univ., Tallahassee). *Journal of the American Chemical Society;* **105**: 5133-5134(1983). Contract AS05-78EV05855.

Further studies on the role of the excited-state proton transfer in O-hydroxychromes in the mechanism of photoautomerization have indicated that the presence of stoichiometric and substoichiometric traces of water, or other H-bonding impurities, in supposedly dry hydrocarbon solvents controls and competes with the excited-state proton transfer. The luminescence behavior of various mixtures of 3-hydroxyflavone and water from 293 to 77K is reported. At temperatures greater than 200K, the roles of water solutes are disguised; but at lower temperatures, the properties of the solvated molecules dominate the excitation processes. All spectra reported are for quick-frozen, rigid-glass samples, because all effects were noted to be strongly temperature and cooling-rate dependent. At 293K normal molecule uv absorption is very closely mimincked by the green tautomer fluorescence, while at the other end of the temperature region studies, 77K, a sharpening and a shift of the excitation spectrum to longer wavelengths were noted.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 45784

45407 **(LA—10227-C-Vol.2, pp 590-610) S(k,omega) and the eigenmodes of classical fluids.** Cohen, E.G.D.; de Schepper, I.M.; Zuilhof, M.J. (Rockefeller Univ., New York, NY). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The lowest lying eigenmodes of a classical fluid have been approximately determined for a wide range of densities and wavenumbers. The most important eigenmodes are direct extensions of the three hydrodynamic heat and sound modes to much larger wavenumbers. A new and consistent interpretation of neutron spectra and related molecular dynamics simulations in terms of these modes is made. Also experimental predictions are discussed, some of which seem particularly suitable for investigating with spallation machines.

45408 (LA—10227-C-Vol.2, pp 456-478) **Bose Condensate in He II.** Svensson, E.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The Condensate Saga, now halfway through its fifth decade, is reviewed. The recent neutron-scattering work which has at last convincingly established that there is indeed a Bose Condensate in He II is described.

45409 **(LBL—17947) Numerical calculation of complex shock reflections in gases.** Colella, P.; Glaz, H.M. (Lawrence Berkeley Lab., CA (USA); Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.). Jun 1984. Contract AC03-76SF00098. 8p. (CONF-840650—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016560.

From 9. international conference on numerical methods in fluid dynamics; Saclay, France (25 Jun 1984).

We present here computational results using second order Godunov methods for time-dependent Eulerian gas dynamics with a general (convex) equation of state. 5 refs., 5 figs.

45410 **(UCRL—89753-Rev.1) Raman spectroscopy of shocked water.** Holmes, N.C.; Nellis, W.J.; Graham, W.B.; Walrafen, G.E. (Lawrence Livermore National Lab., CA (USA); Howard Univ., Washington, DC (USA)). Aug 1985. Contract W-7405-ENG-48. 11p. (CONF-850736—61-Rev.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017401.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

We describe a new technique for recording spontaneous Raman spectra from molecules during the passage of strong shock waves. We have used this technique to study the OH-stretch band of liquid H_2O shocked to pressure up to 26 GPa and 1700 K. The shape of the band changes over the range 7.5-26 GPa, and is described well by a two-component mixture model, implying changes in the intermolecular coupling of shock compressed water molecules. We discuss the implications of the spectra on the mechanism responsible for the electrical conductivity of shocked H_2O. 22 refs., 7 figs., 2 tabs.

45411 **(UCRL—92041) Solution of the field equations for 2-D electromagnetic direct implicit plasma simulation.** Hewett, D.W.; Langdon, A.B. (Lawrence Livermore National Lab., CA (USA)). 2 Jan 1985. Contract W-7405-ENG-48. 5p. (CONF-850659—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016073.

From 11. international conference on numerical simulation of plasmas; Montreal, Quebec, Canada (25 Jun 1985).

A direct implicit particle-in-cell (PIC) simulation model with full electromagnetic (EM) effects has been implemented in 2-D Cartesian geometry. The model, implemented with the D_1 time differencing scheme, was first implemented in a 1-D electrostatic (ES) version to gain some experience with spatial differencing in forms suitable for extension to the full EM field in two dimensions. The implicit EM field solve is considerably different from the implicit ES code. The EM field calculation requires an inductive part as well as the electrostatic and the B field must be self-consistently advanced.

45412 **(UCRL—92739) Harmonic generation of ion waves due to Brillouin backscattering.** Estabrook, K.; Kruer, W.L.; Haines, M.G. (Lawrence Livermore National Lab., CA (USA); Imperial Coll. of Science and Technology, London (UK). Blackett Lab.). 22 May 1985. Contract W-7405-ENG-48. 13p. (CONF-8409229—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016072.

From CECAM workshop transport, interactions and instabilities in laser-plasmas; Orsay, France (24 Sep 1984).

We report results of simulations of stimulated Brillouin backscatter in which we see the second spatial harmonic of the ion density fluctuation and compare with linear, fluid theory. We also describe examples of the competition between Raman and Brillouin backscatter. 21 refs., 3 figs.

45413 **Pair distributions and energy-density functionals for liquid ^{4}He drops.** Pieper, S.C.; Wiringa, R.B.; Pandharipande, V.R. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **32**: No. 5, 3341-3344(1 Sep 1985). Contract W-31-109-ENG-38.

The pair-distribution function $g_3(r_1,r_2)$ in drops of liquid ^{4}He is studied with the variational Monte Carlo method. It is shown that in drops having 70 or more atoms it can be approximated as a functional of the local one-particle density and the separation r_{12}. Energy-density functionals based on this approximation of g_3 give a fairly accurate description of the ground-state properties of the drops.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 45573

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 44929, 44964, 45520, 45574

45414 **(CEA-N—2414) Study of particle production at 90 degrees in proton-antiproton interactions at the CERN SPS collider.** Mansoulie, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1984. 128p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752064.

Particle production at 90 degrees (with respect to the beams) has been studied with the UA2 experiment at the CERN SpantipS collider, at a center-of-mass energy of 540 GeV. We have measured the inclusive production cross sections: for π^0 in the transverse momentum range (Psub(T)) 1.5 to 15 GeV/c, for π^{+-}, K^{+-}, p and anti p from 0.45 to 2 GeV/c, for eta from 3.25 to 6 GeV/c. The measured π^0 production cross section is in good agreement with a QCD based calculation. The K/π ratio shows a clear increase with energy, the eta/π^0 ratio (0.60 +- 0.15) is compatible with the value measured at ISR energies. The fragmentation of hadron jets was studied and was found to be similar to that of the jets produced in e^+e^- annihilations. A search for directly produced electrons has given an upper limit, compatible with the expectations from a theoretical calculation.

45415 **(CERN-EP—85-64) Experimental evidence for the decay W → tau nu/sub tau/ of the charged intermediate vector boson at the CERN pantip collider.** Savoy-Navarro, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 2 May 1985. 22p. (CONF-850278—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901953.

From 5. topical workshop on proton-anti-proton collider physics; St. Vincent, Italy (25 Feb 1985).

Five events with a single hadronic high-p/sub T/ charged track and missing energy are observed in the data of the 1982 and 1983 runs. This signal rises clearly above the background due to the fluctuations of QCD bijets. We interpret these events as evidence of W → tau nu, where $tau^{+-} \rightarrow \pi^{+-}(n\pi^0)nu$. The branching ratio with respect to the electron mode is 0.96 +- 0.45 (stat.). Candidates for monojets and W → tau nu events where $tau^{+-} \rightarrow \pi^{+-}\pi^{-+}\pi^{+-}(n\pi^0)nu$ are also reported. 13 refs., 7 figs., 4 tabs.

45416 **(DESY—84-122) Total cross section γγ->hadrons.** Knies, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752099.

Measurements of the total cross section for γγ-> hadrons are presented. There are new results from double-tagging (P^2not=0, Q^2not=0), single tagging (P^2approx.=0, Q^2not=0), and no-tagging (P^2approx.=0, Q^2approx.=0n experiments at e^+e^- storage rings. The measurements cover a Q^2 range from 0 to 100 GeV^2, and a W range from 2 to 20 GeV. The significance of these data for the interpretation of the photon as a set of vector mesons

(VDM) and as an electromagnetic field quantum coupling to point-like quarks (QPM) is discussed.

45417 **(DESY—85-014) Search for narrow states coupling to tau pairs in radiatiive Y decays.** Albrecht, H.; Binder, U.; Harder, G.; Hasemann, H.; Philipp, A.; Schmidt-Parzefall, W.; Schroeder, H.; Schulz, H.D.; Wurth, R.; Drescher, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1985. Contract AS09-80ER10690. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752019.

We have investigated the decay Y -> γtautau using tagged γ mesons from the decay Y' -> π+π-Y. The photon spectrum exhibits no monochromatic line corresponding to a narrow object decaying into a tau pair and is fully compatible with the expected background contributions. The branching ratio Br(Y -> tau+tau-) is determined to be (3.07 +- 0.46 +- 0.22)%.

45418 **(DESY—85-017) Measurements of tau-lepton production and decay.** Berger, C.; Genzel, H.; Lackas, W.; Pielorz, J.; Raupach, F.; Wagner, W.; Klovning, A.; Lillestoel, E.; Bussey, P.J.; Cartwright, S.L. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752089.

We have studied 419 tau pair events produced in the reaction e^+e^- -> tau^+tau^- at a c.m. energy of 34.6 GeV. We measure the cross section and angular distribution, as well as the decay branching ratios. The production characteristics are consistent with the Standard Electroweak Model predictions of γ and Z^0 interference. The branching ratios are generally consistent with the tau decaying according to standard weak interaction principles, but we observe somewhat more decays resulting in single charged hadrons plus neutrals than are predicted by present theory.

45419 **(DESY—85-022) Search for monojet events produced by virtual Z^0 bosons in e^+e^- annihilation at PETRA.** Bartel, W.; Becker, L.; Cords, D.; Felst, R.; Hagiwara, K.; Haidt, D.; Junge, H.; Knies, G.; Krehbiel, H.; Laurikainen, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752090.

A search was performed for the associated production of two different Higgs bosons via a virtual Z^0 in e^+e^- annihilation (e^+e^- -> $h_1{}^0h_2{}^0$) using the JADE detector at PETRA. This was motivated by the interpretation of the monojet events observed at the CERN panti p collider as anomalous Z^0 decays into two neutral Higgs bosons ($h_1{}^0$ and $h_2{}^0$), where $h_1{}^0$ is stable and escapes detection while $h_2{}^0$ decays into hadrons. Single- or di-jet events with large momentum imbalance are then expected at PETRA energies. No evidence for such events was found in our data; this excludes $h_2{}^0$ masses in the range of 1 to 21 GeV with 95% C.L., if the branching fraction for Z^0 -> $h_1{}^0h_2{}^0$ is larger than one half that for Z^0 -> νsub(μ) anti νsub(μ). The possibility that the monojets could originate from supersymmetric higgsino production from Z^0 decay is also examined.

45420 **(DOE/ER/03065—50) [Studies of interactions between elementary particles and nuclei]. Progress report.** (Duke Univ., Durham, NC (USA). Dept. of Physics). 1 Aug 1985. Contract AS05-76ER03065. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016572.

Data analysis was performed on these four completed experiments: resonance production in π^+p interactions at 15.7 GeV/c, vector meson production from γp interactions at 20 GeV, particle-nucleus interactions at 100 GeV/, and a search for glueballs in π^-p → nK/sub s/K/sub s/π^0 at 25 GeV/c and a measurement of hyperon radiative decays. Progress is also reported on these experiments: charm particle production from pp interactions at 400 and 800 GeV/c, direct photon and charmonium production from 300 GeV/c (π^{+-}, K^{+-}, p^{+-}) d interactions, and a search for a quark-gluon plasma in anti pp collisions at $\sqrt{s}$ = 2 TeV. (LEW)

45421 **(DOE/ER/05861—6) Electron and pion interactions with nuclei. Progress report, August 1, 1984-August 1, 1985.** McCarthy, J.S. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Aug 1985. Contract AS05-78ER05861. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016842.

Progress is reported on an experiment to study inclusive electron scattering from nuclei. Another experiment is reported that studies electroexcitation of Δ in nuclei. A Cherenkov detector was designed, constructed, and tested for permanent placement in the 1.6 GeV magnetic spectrometer detector system at SLAC. Inclusive electron scattering cross sections have been measured. Deep inelastic scattering of electrons on ^{2}H, ^{3}He, and ^{4}He was studied, and the double differential cross-sections spectra obtained are graphed. A proposed experiment to measure electron scattering from tritium and ^{3}He nuclei using a gas target system is described, including a brief description of the target system and of the recent developments in the preparation for the tritium experiment, requirements in the accuracy of the target density, and the performance of the target system used previouly. Elastic and inelastic electron scattering from the isotopes ^{198}Hg and ^{204}Hg are being examined also. 30 refs., 9 figs. (LEW)

45422 **(DOE/ER/40033—82) Experiment to measure the electron neutrino mass using frozen tritium.** Fackler, O.; Jeziorski, B.; Kolos, W.; Monkhorst, H.; Mugge, M.; Sticker, H.; Szalewicz, K.; White, R.M.; Woerner, R. (Lawrence Livermore National Lab., CA (USA); Rockefeller Univ., New York (USA); Warsaw Univ. (Poland); Waterloo Univ., Ontario (Canada); Florida Univ., Gainesville (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). 25 Jun 1985. Contract AC02-81ER40033;W-7405-ENG-48;AC02-76CH03000. 11p. (CONF-850375—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015292.

From 20. Recontre de Moriond; Les Arcs, France (10 Mar 1985).

The authors are performing an experiment to determine the electron neutrino mass with the precision of a few eV by measuring the tritium beta decay energy distribution near the endpoint. Key features of the experiment are a 2 eV resolution electrostatic spectometer and a high-activity frozen tritium source. It is important that the source have electronic wavefunctions which can be accurately calculated. These calculations have been made for tritium and the HeT^+ daughter ion and allow determination of branching fractions to 0.1% and energy of the excited states to 0.1 eV. The authors discuss the excited final molecular state calculations and describe the experimental apparatus.

45423 (INIS-mf—9306, pp H15) **Search for right-handed currents in muon decay.** Balke, B.; Carr, J.; Gidal, G.; Jodidio, A.; Shinsky, K.A.; Steiner, H.M.; Stoker, D.; Strovink, M.; Tripp, R.D. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45424 (INIS-mf—9306, pp H16) **Measurement of the eta parameter in muon decay.** Crowe, K.M.; Bistirlich, J.A.; Bossingham, R.R.; Chacon, A.D.; Clawson, C.W.; Humanic, T.J.; Martoff, C.J.; Meyer, C.A. (Lawrence Berkeley Lab., CA (USA)); Brewer, J.H.; Keitel, R. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.). Contract AS03-81ER40004.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45425 (INIS-mf—9306, pp K1) **Radiative decay of the π^+.** Bay, A.; Joseph, C.; Loude, J.F.; Perroud, J.P.; Ruegger, D.; Schoeri, O.; Steiner, D.; Tran, M.T. (Lausanne Univ. (Switzerland). Inst. de Physique Nucleaire); Elmbt, L. van; Lebrun, M. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45426 (INIS-mf—9306, pp K4) **Search for exotic particles in the decay of K^+.** Ishikawa, T.; Tanaka, K.H.; Akiba, Y.; Iwasaki, M.; Ohtake, S.; Tamura, H.; Nakajima, M.; Yamanaka, T.; Yamazaki, T. (Tokyo Univ. (Japan). Dept. of Physics; Tokyo Univ. (Japan). Meson Science Lab.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45427 (INIS-mf—9306, pp K5) **Search for the decay μ->3e.** Bertl, W.H.; Eichler, R.; Felawka, L.; Walter, H.K. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mittelenergiephysik); Egli, S.; Engfer, R.; Grab, C.; Hermes, E.A.; Kraus, N.; Pruys, H.S. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45428 (INIS-mf—9306, pp N12) **Progress report on recent rare muon decay experiments at the Los Alamos Meson Physics Facility.** Hogan, G.; Bolton, R.; Bowman, J.D.; Carlini, R.; Cooper, M.; Duong-van, M.; Frank, J.S.; Hallin, A.L.; Heusi, P.; Hoffman, C.M. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45429 (INIS-mf—9306, pp G3) **Atomic cascade of anti pp atoms stopped in H_2 gas and their angular momentum state at annihilation.** Ahmad, S.; Amsler, C.; Armenteros, R.; Auld, E.; Axen, D.; Bailey, D.; Barlag, S.; Beer, G.; Bizot, J.C.; Caria, M. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45430 (INIS-mf—9306, pp K2) **Low energy electromagnetic neutral pion form factor.** Poutissou, J.M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility); Hasinoff, M.; Virtue, C.; Waltham, C. (British Columbia Univ., Vancouver (Canada)); Gumplinger, P.; Stetz, A. (Oregon State Univ., Corvallis (USA)); Chew, S.H. (Oxford Univ. (UK)); Lowe, J. (Birmingham Univ. (UK)); Robertson, B.C. (Queen's Univ., Kingston, Ontario (Canada)); Mulera, T. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45431 (INIS-mf—9306, pp K3) **e^+e^- pairs from π^-p at 300 MeV/c.** Tanner, N.W. (Oxford Univ. (UK). Nuclear Physics Lab.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45432 (INIS-mf—9306, pp L1) **Study of antiprotonic X-ray and gamma spectra at LEAR.** Poth, H.; Bueche, G.; Hancock, A.D.; Koch, H.; Koehler, T.; Kreissl, A.; Raich, U.; Rohmann, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik); Findeisen, C.; Repond, J. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45433 (INIS-mf—9306, pp L2) **First observation of the nuclear E2-resonance effect in antiprotonic molybdenum.** Kanert, W.; Hartmann, F.J.; Daniel, H.; Egidy, T. von; Schmidt, G. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik); Reidy, J.J.; Nicholas, M. (Mississippi Univ., University (USA)); Leon, M. (Los Alamos National Lab., NM (USA)); Poth, H.; Bueche, G. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45434 (INIS-mf—9306, pp L4) **X-rays from anti-protonic hydrogen and deuterium.** Baker, C.A.; Batty, C.J.; Clark, S.A.; Kilvington, A.I.; Moir, J.; Sakamoto, S. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.); Davies, J.D.; Gorringe, T.P.; Lowe, J.; Nelson, J.M. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45435 (INIS-mf—9306, pp M18) **Radiative decay widths of the Λsup(*)(1520) resonance.** Bertini, R.; Birien, P.; Catz, H.; Durand, J.M.; Peng, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie); Brueckner, W.; Doebbeling, H.; Kneis, H.; Majewski, S.; Povh, B. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45436 (INIS-mf—9306, pp N10) **anti pp scattering experiments at LEAR.** Clough, A.S. (Surrey Univ., Guildford (UK)); Beard, C.I.; Bugg, D.V.; Edgington, J.A.; Hall, J. (Queen Mary Coll., London (UK)); Bos, K.; Kluyver, J.C.; Kunne, R.A.; Linssen, L. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)); Birsa, R. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45437 (INIS-mf—9306, pp G2) **Resonance production in anti pp annihilations at rest in H_2 gas and search for new resonant states.** Ahmad, S.; Amsler, C.; Armenteros, R.; Auld, E.; Axen, D.; Bailey, D.; Barlag, S.; Beer, G.; Bizot, J.C.; Caria, M. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).
Published in summary form only.

45438 (INIS-mf—9306, pp G8) **Antiproton-proton cross sections in the momentum range from 150 to 600 MeV/c.** Brueckner, W.; Doebbeling, H.; Guettner, F.; Harrach, D. von; Kneis, H.; Majewski, S.; Nomachi, M.; Paul, S.; Povh, B.; Ransome, R.D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45439 (INIS-mf—9306, pp G11) **Investigation of the anti pp->anti ΛΛ reaction near threshold at LEAR.** Barnes, P.D.; Eisenstein, R.A.; Franklin, G.; Grace, R.; Hertzog, D.; Maher, C.; Marlow, O.; Reider, R.; Seydoux, J.; Szymanski, J. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45440 (INIS-mf—9306, pp L3) **Measurements of strong interaction effects in antiprotonic - He atoms.** Baker, C.A.; Batty, C.J.; Clark, S.A.; Sakamoto, S. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.); Davies, J.D.; Gorringe, T.P.; Lowe, J.; Nelson, J.M.; Playfer, S.M.; Pyle, G.J. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45441 (INIS-mf—9306, pp M14) **Low energy K^-p interactions.** Conboy, J.E.; Miller, D.J. (University Coll., London (UK)); Tymieniecka, T.; Zakrzewsky, J.A. (Warsaw Univ. (Poland)); Evans, D.; Major, J.V. (Durham Univ. (UK)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45442 **(INIS-mf—9342) Experiments at CERN in 1984.** (European Organization for Nuclear Research, Geneva (Switzerland)). Nov 1984. 330p. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781548.

This book is a compilation of the current experimental program at CERN. The experiments listed are being performed at one of the following machines: the Super Proton Synchrotron (SPS), the Proton Synchrotron (PS) and the Synchro-Cyclotron (SC). The Intersecting Storage Rings (ISR) have ceased functioning early this year. The four approved experiments to be done by means of the Large Electron Positron machine (LEP) are also listed.

45443 (INIS-mf—9489, pp 427-487) **Physics at the pp-bar collider.** Humpert, B. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The pp-bar collider at the CERN-SPS will soon be ready for experimentation up to 540 GeV center-of-mass energy. Aiming at an evaluation of the physics in this new energy range we assemble significant results from present accelerators and from cosmic-ray analyses together with the theoretical interpretations. Their extrapolation to collider energies leads to a wealth of predictions which await to be tested. (author).

45444 (INIS-mf—9489, pp 84-101) **What can we learn from structure functions measured in neutrino interactions.** Eisele, F. (Dortmund Univ. (Germany, F.R.). Abt. Physik). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The new measurements of structure functions by the CDHS-collaboration are substantially improved compared to published results. It is discussed how much we can learn from these data about QCD and the gluon distribution by the analysis of moments and of the full x-dependence. It is shown that these new data combined with SLAC ed-data are able to separate QCD-effects from higher twist and other possible non perturbative effects within "reasonable" assumptions. The presence of non perturbative contributions is required at large x (x larger or equal 5) and low Q^2 only. Their shape and magnitude agree well with popular models of diquark contributions. The analysis results in a value of Λsub(MS-bar) = .2 +- .1. (author).

45445 (INIS-mf—9489, pp 383-401) **Review of proton lifetime experiments.** Engels, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires; Pittsburgh Univ., PA (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The experiments on instability of the nucleon carried out in University of Pensylvania, Osaka University as well as in the frame work of Orsay-Palaiseau-Sacley-Wuppertal collaboration are described. (A.S.).

45446 (INIS-mf—9489, pp 75-80) **Prompt single muon production by protons on iron.** Bodek, A.; Breedon, R.; Coleman, R.N. (Rochester Univ., NY (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

A new experiment has been performed at Fermilab to measure the hadronic production of prompt single muons. A preliminary analysis of a sample of the data indicates approximately equal production of prompt single μ^+'s and μ^-'s in 350 GeV p-Fe interactions. The observed momentum distributions of prompt single μ^+'s and μ^-'s can satisfactorily be fit by the hypothesis of central production of D mesons with a cross section of 16 +- 4 μb/nucleon.

45447 (INIS-mf—9489, pp 103-123) **Neutrino oscillations - present and future experiments.** Wotschack, J. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The general conception of neutrino oscillations is shortly described and the review of present experimental results is given. However the obtained results are not convincing evidence for existence of neutrino oscillations nevertheless they throw some light on this phenomenon. The programs of future experiments in Brookhaven, Los Alamos and CERN are briefly presented.

45448 (INIS-mf—9489, pp 125-133) **Neutron and proton structure functions from inelastic antineutrino scattering in deuterium.** Flaminio, V. 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The scattering of neutrino/antineutrino on neutrons and protons carried out at CERN-SPS at 10 GeV is described. The obtained results are compared with theoretical models. In particular the x and y - distributions of quarks having definite flavours and the values of the ratios of cross sections intergrated over kinematical variables Σ(ν-barsub(n)) / Σ(νsub(ν)) and Σ(νsub(n)) /

Σ(νsub(p)) for cc-bar interactions are given and compared with Field and Feynman predictions as well as Buras - Gaemers model.

45449 (INIS-mf—9489, pp 9-44) **Aspects of experimental high transverse momentum physics.** Geist, W.M. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

New results from experiments looking for large transverse momentum processes in hadron interactions are discussed. Multiparticle final states associated with a single high psub(T) particle show clear jet structure. Properties of these jets and inclusive single particle spectra indicate that, in addition to valence quarks, gluons contribute substantially to high psub(T) phenomena. Evidence for multijet production is briefly presented. Data from calorimeter experiments, which aim at a detection of the total jet energy, do not show jet structure.

45450 (INIS-mf—9489, pp 45-68) **Experimental review of some predictions of the Drell Yan model in hadroproduction of dimuons.** Burgun, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Some known models of hadron-hadron interaction (Drell-Yan and twist model of Berger and Brodsky) are presented. Comparison between the experimental data on hadroproduction of dimuons and the predictions of the Drell-Yan model as to angular distribution, absolute cross section, beam dependence and scaling is given.

45451 (INIS-mf—9489, pp 187-196) **New O^-S meson and new results on the 1^+S state in the 3π system coherently produced on nuclei; 5π coherent production on nuclei.** Bellini, G.; Di Corato, M.; Frabetti, P.L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

About 120000 events of the three-pion production on Be, C, Al, Si, Ti, Cu, Ag, Ta and Pb targets were studied at 40 GeV at the Serpukhov PS accelerator. Also about 15000 events of the five-pion production on the some nuclei were investigated.

45452 (INIS-mf—9753) **Energy dependence of proton-proton and antiproton-proton scattering at the CERN intersecting storage rings.** Botje, M.A.J. (Rijksuniversiteit Utrecht (Netherlands)). 6 Dec 1984. 163p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781538.

Includes Dutch summary; 97 refs.; 60 figs.; 19 tabs.

This thesis describes measurements of proton-proton and proton-antiproton elastic scattering with the scattered particles emerging at small angles in the centre of mass (CM) system. These measurements have been performed at the CERN Intersecting Storage Rings (ISR). The direct comparison of pp and anti pp scattering in this energy range is of considerable interest. This is because measurements on pp scattering alone, have revealed that in the ISR energy range both elastic- and total pp cross-sections increase with increasing energy. It is the subject of this thesis to check the prediction that the proton-antiproton cross section will do the same. The present experiment measures the angular distribution of pp and anti pp elastic scattering at small angles (typically 1-10 mrad) and at different energies. From these measurements a comparison of the energy behaviour of the pp and anti pp forward nuclear scattering amplitudes is obtained. This behaviour can be described in terms of three parameters: the total cross-section, the ratio of the real-to-imaginary part of the forward nuclear amplitude and a parameter, the slope, characterising the dependence of the process on the squared four-momentum transfer between the incident and the scattered particle.

45453 (LAPP-T—84-02) **Measurement of $\pi 0$ inclusive production cross sections in proton-antiproton interactions at $\sqrt{s}$=540 GeV at CERN.** Cuillerey, R. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules; Grenoble-1 Univ., 38 - La Tronche (France)). Jun 1984. 134p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752066.

The measurement of the π^0 inclusive yield cross-section is the main point of this research from the UA1 collaboration at CERN. This measurement and its comparison with the jet yield, allows to conclude in favour of some important predictions of the theoretical model of partons. The π^0 distribution also allows to an estimation of the background over the W identification through the channel $W \rightarrow e+\nu$sub(e).

45454 (NIKHEF-H—84-16) **New experimental results in two-photon physics.** Paar, H.P. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Dec 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701931.

New experimental results in two-photon physics are discussed. The subjects covered are total cross-section, the ratio of hadron to muon production, structure functions in inelastic lepton-photon scattering and exclusive resonance production. It is shown that these processes are well described by QCD, augmented by quark parton model and vector meson dominance notions. Some aspects of the data for exclusive resonance production may be interpreted as evidence for glueballs.

45455 (SLAC—283) **Workshop on e^+e^- physics at high luminosities: proceedings.** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1985. Contract AC03-76SF00515. 391p. (CONF-8411186—; CONF-8504155—). NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE85016524.

From Workshop on e+e- physics at high luminosities; Stanford, CA, USA (30 Nov 1984).

Separate abstracts were prepared for 10 papers in this workshop proceedings. (LEW)

45456 (SLAC-PUB—3643) **Spectroscopy of the Y(2S) with the Crystal Ball.** Irion, J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); Harvard Univ., Cambridge, MA (USA). Dept. of Physics). Apr 1985. Contract AC03-76SF00515. 9p. (CONF-8504133—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015970.

From International conference on hadron spectroscopy; College Park, MD, USA (20 Apr 1985).

The Crystal Ball experiment has been taking data at the DORIS II storage ring at DESY/Hamburg on the Y(2S) and Y(1S) resonances since summer 1982. Results on the hadronic transitions between the Y(2S) and the Y(1S) are presented as well as measurements of the radiative decays of the Y(2S) to the chi/sub b/ states in inclusive and exclusive channels. The exclusive $Y(2S) \rightarrow \gamma$chi/sub b/ $\rightarrow \gamma\gamma Y(1S) \rightarrow \gamma\gamma l^+l^-$ sample allows a study of the spins of the chi/sub b/ states. Also discussed is the present status of the zeta(8.3) in the radiative decays of the Y(1S). 22 refs., 14 figs.

45457 **Study of D/sup / production in high-energy γp interactions.** Sliwa, K.; Appel, J.A.; Biel, J.; Bintinger, D.; Bronstein, J.; Daum, C.; Mantsch, P.M.; Nash, T.; Purohit, M.V.; Schmidke, W. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Physical Review* [*Section*] *D: Particles and Fields;* **32**: No. 5, 1053-1060(1 Sep 1985).

We have studied D(production mechanisms using data from a photoproduction experiment at the Fermilab Tagged Photon Spectrometer. A large sample of charged D('s was selected via the clean signature of the cascade decay $D(\rightarrow D^0\pi^+$ and subsequently $D^0 \rightarrow K^-\pi^+$ or $D^0 \rightarrow K^-\pi^+\pi^0$. The cross section for the process $\gamma p \rightarrow$(D/sup asterisk+/+anything)p at an average energy of 105 GeV was measured to be 88 +- 32 nb. Only (11 +- 7)% of D('s were found to be consistent with being accompanied solely by a D-bar(or a D-bar; the remaining events contain additional particles. The distribution of the production angle of the D(in the photon-fragmentation-system center of mass is strongly anisotropic and

consistent with the form f(θ() = cos⁴θ(. We set a limit on the associated-production-process cross section σ(γp→(D-bar/sup asterisk-/+anything)Λ/sub c/) <60 nb (90% C.L.).

45458 Triggered-bubble-chamber study of the reaction $\pi^+ p \to \Delta^{++} \pi^0 \pi^0$ at 16 GeV/c. Clark, R.K.; Barlow, P.M.; Diamond, R.N.; Hagopian, V.; Lannutti, J.E.; Spencer, C.M.; Ferguson, M.; Glanzman, T.; Goshaw, A.T.; Lucas, P. (Florida State University, Tallahassee, Florida 32306). *Physical Review [Section] D: Particles and Fields;* **32**: No. 5, 1061-1070(1 Sep 1985).

The SLAC 40-inch bubble chamber augmented by an array of lead-glass detectors was used to study the reaction $\pi^+ p \to \Delta^{++} \pi^0 \pi^0$ at 15.7 GeV/c. No new high-mass neutral mesons are seen at a sensitivity of 14.2 events/μb. A moments and amplitude analysis indicates that only S and D waves contribute to the $\pi^+ \pi^- \to \pi^0 \pi^0$ cross section. A one-pion-exchange-model calculation is performed using phase-shift measurements from other experiments. The older phase shifts from Estabrooks and Martin are in better agreement with our data than are the more recent ones of Biswas et al.

45459 Measurement of $e^+ e^- \to \mu^+ \mu^-$: A test of electroweak theories. Adeva, B.; Becker, U.; Becker-Szendy, R.; Berdugo, J.; Boehm, A.; Branson, J.G.; Burger, J.D.; Capell, M.; Cerrada, M.; Chang, C.C. (III. Physikalisches Institut, Technische Hochschule, D-5100 Aachen, Federal Republic of Germany; Brookhaven National Laboratory, Upton, New York 11973; California Institute of Technology, Pasadena, California 91125; Deutsches Elektronen Synchrotron DESY, D-2000 Hamburg 52, Federal Republic of Germany;). *Physical Review Letters;* **55**: No. 7, 665-668(12 Aug 1985).

We use the reaction $e^+ e^- \to \mu^+ \mu^-$, in the Mark J detector at the DESY high-energy $e^+ e^-$ collider PETRA, to test the standard electroweak theory and find good agreement. We also set limits on the parameters of several extended gauge theories.

45460 (DESY-L-Trans—300) Search for light particles with charge 2/3 in $e^+ e^-$-annihilaton. Bondar, A.E.; Kuradze, L.M.; Lelchuk, M.Yu.; Panin, V.S.; Sidorov, V.A.; Chilingarov, A.G.; Schwarz, B.A.; Eidelman, S.I. Translated from *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki ;* **40**: No. 10, 324-327(1985). 5p. Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany, F.R.

Translated from Russian.

The upper limit for the production cross-section of particles with charge 2/3 and a mass up to 0.4 GeV in the reaction $e^+ e^-$ -> qanti q:sigmasub(qq) / sigmasub(μμ) < 10^{-4} has been determined by means of the detector OLYA of the collider VEPP-2M. This limit was two orders lower than the results of previous experiments sensitive to quarks of small mass.

45461 Ksup(*+-)(892) production in $\pi^- N$ interactions at 200 GeV/c. Napier, A.; Schneps, J. (Tufts Univ., Medford, MA (USA)); Chen, T.Y.; Jenkins, E.W.; Lai, K.W.; Le Britton, J.; Lin, Y.C.; Pifer, A.E. (Arizona Univ., Tucson (USA)); Fenker, H.C.; Green, D.R. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters, [Section] B;* **149**: No. 6, 514-518(27 Dec 1984).

Ksup(*+-) (892) production is studied in the reaction $\pi^- N$ -> Ksub(s)°Ksub(s)°+X where X includes up to five observed charged particles. An excess of Ksup(*-) over Ksup(*+) is observed for Feynman-chi > 0.1. The ratio of Ksup(*+) to Ksup(*-) decreases with chi as predicted by QCD counting rules. Ksub(s)° and Ksup(*) production are compared to recent D and Dsup(*) data from other experiments.

45462 Observation of two non-leading strangeness-one vector mesons. Aston, D.; Dunwoodie, W.; Durkin, S.; Honma, A.; Hutchinson, D.; Johnson, W.B.; Kunz, P.F.; Lasinski, T.; Leith, D.W.G.S.; Levinson, L. (Stanford Linear Accelerator Center, CA (USA)). *Physics Letters, [Section] B;* **149**: No. 1-3, 258-262(13 Dec 1984).

We present evidence for the existence of two strange Jsup(P)=1^- mesons; one at 1410 MeV/c^2 coupling principally to Ksup(*)(892)π, and the other at 1790 MeV/c^2 coupling to Kπ, Ksup(*)π and rhoK. The data derive from a partial wave analysis of the anti $K^0 \pi^+ \pi^-$ system produced in the reaction $K^- p$ -> anti $K^0 \pi^+ \pi^- n$ at 11 GeV/c. The production mechanism and quark model assignment of each state are discussed. The state at 1410 MeV/c^2 is most naturally understood as the first radial excitation of the Ksup(*)(892), and the 1790 MeV/c^2 object can be interpreted as the triplet D wave partner to the 3^- Ksup(*)(1780).

45463 Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K-trigger. Gorbics, M.S. Ames, Iowa; Iowa State Univ. (1984). 65p. University Microfilms Order No. 85-05,819.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The production of charm mesons D/sup */ and D and their subsequent decays D/sup *+/ → $D^0 \pi^+$ and $D^0 \to K^- \pi^+$ have been observed in proton-proton interactions at the CERN Intersecting Storage Rings. Using published data for inclusive K^- and anti p cross sections as normalization, the D/sup *+/ production cross section is estimated. For a model with the D/sup *+/ produced with a Feynman-x (x/sub F/) distribution of the form (1 - x/sub F/)³ and a transverse momentum distribution of the form P/sub t/ sup */exp(-P/sub t/²), the D/sup *+/ production cross section is estimated to be 23.5 +/- 8.4 μb. This measurement is approximately the same as measurements by other experiments of charm meson production at lower energies. Two other experiments have measured the D^0 production cross section at the author's energy and obtained a result more than ten times higher than the author's. Thus, the author's measurement provides a possible resolution to what had been an unclear situation in regard to the energy dependence of charm production.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 45330, 45336, 45452, 45457, 45559, 45701, 45764

45464 (BNL—36724) Who ordered the muon. From families to communities. Senjanovic, G. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 8p. (CONF-850375—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016058.

From 20. Recontre de Moriond; Les Arcs, France (10 Mar 1985).

I review the possibility that the underlying theory of weak interactions possesses a family symmetry, either global or local. The spontaneous symmetry breaking of this symmetry leads to important phenomenological implications: the existence of Goldstone bosons, the familons in the case of global symmetry and the existence of mirror fermions, in the case of local symmetry (in the context of grand unification). Both alternatives will soon be tested. 13 refs.

45465 (CBPF-NF—002/84) Diffractive dissociation in $pp \to \Delta^{++} \pi^- p$. 2. Slope-mass-partial wave correlation. Antunes, A.C.B.; Santoro, A.F.S.; Souza, M.H.G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701926.

Partial wave amplitudes are calculated and the results obtained for the slope-mass-partial wave correlation are given.

45466 (CEA-CONF—7248) A-dependence of deep inelastic lepton-nuclear scattering from 6-quark clustering. Chemtob, M.; Peschanszi, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1984. 9p. (CONF-8403121—12; SPhT—84-49). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751167.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

The correction to the nucleon valence quark structure functions implied by 6-quark clustering in nuclei are found to be in remarkable agreement with recent data from S.L.A.C. on the A-dependence of electron-nucleus deep inelastic scattering.

45467 **(CEA-CONF—7529) Constructive approach to the ground-state energy of a hard-core square-well fermion system.** Baker, G.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 3p. (CONF-8409187—2; SPhT—84-140). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752067.

From 8. international workshop on condensed matter theories; Granada, Spain (17 Sep 1984).

The old problem of the ground state energy of quantum many fermions systems is studied. This approach is to expand the energy in a double series, The Fermi momentum and the strength of the attractive part of the potental.

45468 (CERN—84-15, pp 63-77) **Antiproton production.** Allaby, J.V. 20 Dec 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85701982. (CONF-831079—).

From CERN Accelerator School course on antiprotons for colliding beam facilities; Geneva, Switzerland (11 Oct 1983).

The basic definitions used in the physics literature on particle production are reviewed. The data on anti p production are interpreted in order to provide an estimate of the yield of anti p's from typical target at the antiproton accumulator, including the effects of re-absorption in the target.

45469 **(DESY—85-024) Improved continuum limit lattice action for QCD with Wilson fermions.** Sheikholeslami, B.; Wohlert, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752093.

Two possible ways of extending Symanzik's improvement programme to lattice fermions namely improvement to first and second order in the lattice spacing 'a' are discussed. The corresponding lattice actions for fermions are constructed and tree level improvement conditions are derived by considering classical improvement. The concept of on shell improvement is generalized to the lattice fermions studied here and the free parameters are determined for O(a) and O(a^2) on shell improved actions to all orders of perturbation theory. No evidence is found that the complicated structure of the O(a^2) on shell improved action especially the arising fermion contact terms can be removed beyond tree level. The effect of terms in the action that explicitly break chiral symmetry and therefore remove the phenomenon of species doubling are investigated by considering the energy momentum relations of the arising tree level improved actions. Our main result is that the O(a) improved action is a slightly modified Wilson fermion action which can still be written with only nearest neighbour fermion interactions.

45470 **(DESY—85-025) Excited lepton production at LEP and HERA.** Hagiwara, K.; Zeppenfeld, D.; Komamiya, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752130.

General expressions for single and pair production cross sections of excited leptons (esup(*), μsup(*), νsup(*)) are presented. Specific results are shown for a realistic SU(2) x U(1) invariant model. Pair production in e^+e^- annihilation can measure anomalous magnetic moments of excited leptons. Single production of e* is dominated by the t-channel γsup(*) exchange contribution which makes its detection feasible up to masses just below the e^+e^- c.m. energy. Due to this small vertical stroketvertical stroke enhancement effect, contributions from elastic and resonance scattering in ep production of esup(*) are substantial. Realistic estimates of the excited lepton production cross section at HERA are given.

45471 **(DESY—85-032) Light gluino scenario.** Barger, V.; Jacobs, S.; Woodside, J.; Hagiwara, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 35p. (MAD/PH—232). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752132.

We investigate in detail the consequences of the supersymmetry scenario with a light (proportional 5 GeV) gluino and heavy (proportional 100 GeV) squarks, including gluino distribution and fragmentation effects, proposed to explain large missing psub(T) events observed at the CERN p anti p collider. The effective gluino distribution in the nucleon is evaluated using the Altarelli-Parisi equations. Ambiguities in evaluating squark production with the effective gluino distribution are discussed. A plausible gluino fragmentation function is deduced from heavy-quark fragmentation functions; scaling violations in the gluino fragmentation function are taken into account. Fragmentation effects drastically reduce the missing psub(T) in light gluino jets. The present collider data do not rule out a light gluino with mass in the range of 3-5 GeV even if the anti g lifetime, from decay into a photino and a quark pair, is short.

45472 **(DOE/ER/10713—1) Theory of weak interactions and related topics. Progress report, January 1-December 31, 1980.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016839.

The work reported included an effort to understand the physical meaning of the U(1) hypercharge group in the accepted electroweak SU/sub L/(2) x U(1) group, as well as other facets of the electroweak structure (e.g., the persistence of the V-A charged current despite the finite masses of the quarks and leptons, the meaning of quark-lepton symmetry for all three generations). It was shown that, unlike the case of the SU(2)/sub L/ x U(1) model, the vector U(1) generator in the SU(2)/sub L/ x SU(2)/sub R/ x U(1) model can be identified with (B-L) symmetry. Consequences were explored of the idea that the breakdown of parity is related to the non-conservation of global B-L. One consequence is that two Majorana neutrinos, one light and one extremely heavy, are predicted for each generation. Also examined were the questions of the magnitudes of various B-violating amplitudes and the kinds of selection rules governing these processes. 18 refs. (LEW)

45473 **(DOE/ER/10713—2) Theory of weak interactions and related topics. Progress report, January 1-December 31, 1981.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016838.

The research program demonstrated that the acceptance of B-L local symmetry as the weak hypercharge, whose spontaneous breakdown was connected to the spontaneous breakdown of parity, predicted a light electron neutrino (Majorana) and a related heavy neutrino. The prediction of neutron oscillations following from the PUT group SU(4)/sub C/ x SU(2)/sub L/ x SU(2)/sub R/ was scrutinized. A relation was derived between the mixing time for free neutron oscillations and the lifetime for nuclear stability with respect to $\Delta B = 2$ transitions, and a study was conducted of the effect of time-varying or spatial-varying magnetic fields on the mixing time of neutron oscillations. Reasons are given for continuing work with the left-right symmetry (LRS) and partial unification theory (PUT) groups to their grand unification realization. It was shown that, without assuming a simple GUT group, that the color group has to be SU(3) and that the only possible GUT groups are SU(5) and SU(10). The gauge boson mass relation was derived for arbitrary Higgs structure associated either with the standard SU(2)/sub L/ x U(1) electroweak group or the LRS group. Also examined was the Pati-Salam type of grand unification. 31 refs. (LEW)

45474 **(DOE/ER/10713—3) Theory of weak interactions and related topics. Progress report, January 1, 1982-February 28, 1983.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016837.

Progress is reported in these areas: B-L vs V-A gauge groups; work on neutron oscillations; preon models of quarks and leptons; partial unification theory (PUT); extensions of standard electroweak group; composite weak bosons; quasi-solitons in electroweak gauge groups; and weak CP nonconservation. 18 refs. (LEW)

45475 **(DOE/ER/10713—4) Theory of weak interactions and related topics. Progress report, March 1-December 31, 1983.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016836.

Progress is reported in these areas: extensions of the standard electroweak model; neutron oscillations; partial unification and grand unification - SU(4)/sub C/ x SU(2)/sub L/ x SU(2)/sub R/ and SO(10) groups; preon models of quarks and leptons; solitons and anomalies in gauge theory. 41 refs. (LEW)

45476 **(DOE/ER/10713—5) Theory of weak interactions and related topics. Progress report, January 1-December 31, 1984.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016843.

Progress is reported in these areas: (a) B-L Unification Theories; (b) Preon models of quarks and leptons; (c) Topics in Supersymmetry, Solitons, Anomalies and Supergravity; (d) Miscellaneous topics. 19 refs.

45477 **(DOE/ER/10713—6) Theory of weak interactions and related topics. Progress report, January 1, 1985-August 1, 1985.** Marshak, R.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). Aug 1985. Contract AS05-80ER10713. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016844.

Progress is reported in these areas: (1) Preon models of quarks and leptons; (2) Topics in Supersymmetry and Supergravity; (3) Miscellaneous topics.

45478 (INIS-mf—9306, pp H7) **Hard meson corrections to the radiative muon capture amplitude.** Klieb, L. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45479 (INIS-mf—9306, pp H10) **Parity nonconserving electroweak effects in radiative nucleon-nucleon scattering.** Kopeliovich, V.B. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45480 (INIS-mf—9306, pp H12) **V-A structure of the charged weak current of the tau lepton and the reaction γ + N -> lsup(+-) + upsilonsub(l) + N'.** Garcia, J.H.; Perez, M.A. (Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45481 (INIS-mf—9306, pp H18) **Time-reversal-violating effects in semileptonic decays in SU(2)sub(L) x SU(2)sub(R) x U(1) electroweak models.** Herczeg, P. (Los Alamos National Lab., NM (USA). Theoretical Div.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45482 (INIS-mf—9306, pp H21) **Electroweak gauge model without Higgs boson.** Tsai, S.Y. (Nihon Univ., Tokyo. Coll. of Science and Technology). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45483 (INIS-mf—9306, pp H23) **Influence of the weak electron-nucleus interaction on the electromagnetic waves propagation in media.** Altshuler, E.L.; Fomichev, V.N.; Moskalev, A.N.; Ryndin, R.M.; Ryzhov, V.A. (Leningrad Inst. of Nuclear Physics, Gatchina (USSR)); Khriplovich, I.B.; Silvestrov, P.B. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45484 (INIS-mf—9306, pp K7) **Origin of the $\Delta I=1/2$ rule and Ksub(L) rare decays.** Bergstroem, L. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden)); Masso, E. (Stanford Linear Accelerator Center, CA (USA)); Singer, P. (Technion-Israel Inst. of Tech., Haifa). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45485 (INIS-mf—9306, pp M27) **Kaon decays and a determination of the scale of chiral symmetry.** Donoghue, J.F.; Golowich, E.; Holstein, B.R. (Massachusetts Univ., Amherst (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45486 (INIS-mf—9306, pp H1) **Possible higher precision measurement of the muon G-2 value.** Hughes, V.W. (Yale Univ., New Haven, CT (USA). Dept. of Physics); Danby, G.T. (Brookhaven National Lab., Upton, NY (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45487 (INIS-mf—9306, pp H6) **Parity violation in the nucleon wave function, electromagnetic interaction and PNC meson-nucleon coupling constants.** Desplanques, B.; Noguera, S. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45488 (INIS-mf—9306, pp H11) **Weak pion production with kaons.** Barroso, A. (Lisbon Univ. (Portugal)); Tadic, D. (Zagreb Univ. (Yugoslavia). Zavod za Theorijsku Fiziku); Trampetic, J. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Inst. fuer Physik). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45489 (INIS-mf—9306, pp I55) **Proton and the neutron RMS charge radii and the sizes of their bags.** Anagnostatos, G.S. (Democritos Nuclear Research Center, Athens (Greece). Tandem Accelerator Lab.); Kosmas, T.S. (Ioannina Univ. (Greece)); Panos, C.N. (Southeastern Coll., Kifissia, Athens (Greece)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45490 (INIS-mf—9306, pp M22) **Decay $K^- p \rightarrow \Lambda\gamma$ at rest.** Lowe, J. (Birmingham Univ. (UK). Dept. of Physics); Burkhardt, H. (Nottingham Univ. (UK). Dept. of Mathematics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45491 (INIS-mf—9306, pp I49) **Possible existence of narrow (ΔN) resonances.** Hopf, H.G.; Klingenbeck, K.; Dillig, M. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Huber, M.G. (Bonn Univ. (Germany, F.R.). Inst. fuer Theoretische Kernphysik). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45492 (INIS-mf—9306, pp J5) **Violation of Feynman scaling in yields of hadron beam fragments from nucleons and nuclei.** Anisovich, V.V.; Braun, V.M.; Shabelski, Yu.M. (Leningrad Inst. of Nuclear Physics, Gatchina (USSR)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45493 (INIS-mf—9306, pp J14) **Particle production from a condensing quark-gluon plasma.** Phatak, S.C. (Institute of Physics, Bhubaneswar (India)); Sarma, N. (Bhabha Atomic Research Centre, Bombay (India)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

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45494 (INIS-mf—9306, pp L32) **Atomic states in nonelastic scattering processes.** Sienkan, K.; Wycech, S. (Institute for Nuclear Studies, Warsaw (Poland)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45495 (INIS-mf—9306, pp M12) **P-wave $K^+ N$ scattering.** Mukhopadhyay, D.; Pirner, H.J. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik; Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45496 (INIS-mf—9306, pp M16) **Kaon-nucleon scattering in the cloudy bag model.** Veit, E.A.; Jennings, B.K. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility); Thomas, A.W. (Adelaide Univ. (Australia). Dept. of Physics); Barrett, R.C. (Surrey Univ., Guildford (UK). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45497 (INIS-mf—9306, pp M19) **Nature of the Λsup(*)(1405).** Veit, E.A.; Jennings, B.J. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility); Barrett, R.C. (Surrey Univ., Guildford (UK). Dept. of Physics); Thomas, A.W. (Adelaide Univ. (Australia). Dept. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45498 (INIS-mf—9306, pp M28) **Relatively stable strange dibaryons.** Aerts, A.T.M. (European Organization for Nuclear Research, Geneva (Switzerland). Theoretical Physics Div.); Dover, C.B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45499 (INIS-mf—9306, pp N9) **Recoilless production of pionic nuclei.** Ericson, T.E.O.; Kilian, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45500 (INIS-mf—9489, pp 135-139) **Spin effects in $e^+ e^-$ annihilation.** Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Cross sections and spin asymmetries for large p perpendicular jet production from two photon processes in $e^+ e^-$ collisions with definite helicities as well as the production of polarized hadrons in polarized and unpolarized single photon $e^+ e^-$ annihilation processes are discussed. (author).

45501 (INIS-mf—9489, pp 213-260) **Spin physics at short distances as a means of studying QCD.** Craigie, N.S. (International Centre for Theoretical Physics, Trieste (Italy); Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

We review how experiments with polarized beams and/or targets can be used to test QCD perturbation theory and to throw some light on the role of next to leading logarithmic orders and power corrections. All the processes we will consider, are the so-called hard processes involving a single short distance scale and are characterized by the remarkable factorization property of parton densities. (author).

45502 (INIS-mf—9489, pp 489-524) **Jets in $e^+ e^-$ annihilation and QCD.** Barreiro, F. 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The problems of the determining the strong coupling constant, the spin of the gluon and understanding the energy dependence of jet measures in e^+e^- annihilation are discussed with connection of the approaches consisting in searching for measures which don't depend or minimally depend on fragmentation effect or whose dependence can be educately guessed with an analytical parametrization. (J.T.).

45503 (INIS-mf—9489, pp 261) **Diagrammatic mass factorization.** Humpert, B. (European Organization for Nuclear Research, Geneva (Switzerland); Schweizerisches Inst. fuer Nuklearforschung, Villigen). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Published in summary form only.

45504 (INIS-mf—9489, pp 69-74) **Hyperon polarization in inclusive and exclusive processes.** Szwed, J. (Uniwersytet Jagiellonski, Krakow (Poland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Hyperon polarization in inclusive and exclusive processes is explained by multiple scattering of the strange quark. Energy, Feynmann x and transverse momentum dependence is discussed, relations between polarizations of different hyperons in various processes are given. The charmed and bottom baryons are predicted to be analogically polarized.

45505 (INIS-mf—9489, pp 197-206) **Two particle correlations in pion-nucleus interactions at 40 GeV/c.** Abrosimov, A.T. (Moskovskij Gosudarstvennyj Univ. (USSR)); Bellini, G.; Di Corato, M (Milan Univ. (Italy). Ist. di Fisica). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Multiplicity distributions and two-particle correlation functions are presented for shower particles with pseudorapidity eta > 1 produced in π^- interactions on C, Al, Cu, Pb targets at incident pion momentum 40 GeV/c. Results are compared with the π^-p data. No noticeable differences were found between the nuclear and elementary distributions of the correlation function. The data are compared with the predictions of the additive quark model and the quasieikonal model.

45506 (INIS-mf—9489, pp 141-186) **Hadroproduction of charmed particles.** Muller, F. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Experimental results of various experiments pp→ DD-barX or pp→Asub(c)D-barX (x=single lepton, neutrino beam dump, beam-dump muon) are presented and discussed. The methods of detection of charmed particles via some characteristic feature of their decays are described.

45507 (IPNO-TH—83-35) **Self-consistent light-quark qqq and qq anti q anti q mass spectrum.** Balazs, L.A.P.; Nicolescu, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751163.

Recently, an improved approximate self-consistent dual topological unitarization technique has been developed, in which the effect of planar "sea"-quark loops is taken into account from the beginning. This is applied to qqq and qq anti q anti q hadrons with q=u, d, s, and good agreement is obtained with experiment. In particular, we predict 2^- and 3^+ A anti p states which could be identified with recently observed broad resonances of mass 2.20 and 2.33 GeV.

45508 (LAPP-TH—82) **Properties of the W boson in some composite models.** Girardi, G.; Narison, S.; Perrottet, M. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jul 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751166.

We analyze the effects of some electroweak interaction models with a composite W at present energies. We find that the width of the W into pairs of pseudoscalar bosons can be appreciable and may reduce its leptonic branching ratio by about 20%. The front-back asymmetry of leptons at the proton-antiproton collider is similar to the one obtained in the standard model.

45509 (LAPP-TH—100) **High Psub(T) prompt photons in pp and p anti p collisions as a test of perturbative QCD.** Douiri, A. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Mar 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751165.

The results of the complete O(αsub(s)sup(2)) calculation of high Psub(T) prompt photons in pp and p anti p collisions are reviewed. The corrections show a strong dependence on the factorization prescription and scale. Our numerical predictions are confronted with the ISR and UA2 data; good agreement is found.

45510 (LAPP-TH—116) **Formation and stability of quantised (non-abelian) magnetic monopoles: a lattice Monte Carlo study.** Schierholz, G.; Seixas, J.; Teper, M. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jul 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752041.

We put the Georgi-Glashow model on a lattice, and use Monte Carlo techniques to investigate the quantum physics of its monopoles. For appropriate bare couplings the monopoles are stable (suggesting that theories in which the Higgs scalars are composite will also generate monopoles). We show how the history of a monopole depends on the volume of space-time in which it is originally created; anti-monopoles usually appear in "hot-spots" on the domain wall separating the monopole from the rest of the universe, and these may annihilate with the monopole, or they may form a quasi-stable system. We observed how a condensation of "(anti)-monopole" vacuum fluctuations can restore the broken symmetry. We also observe that in the BPS limit quantum fluctuations restore the symmetry, so that in that limit there are no monopoles.

45511 (LPC—84-28) **Processes related to photon-photon collisions.** Kessler, P. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Nov 1984. 31p. (CONF-8409194—7). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752065.

From 6. international workshop on photon-photon collisions; Lake Tahoe, CA, USA (9 Sep 1984).

Two types of processes, related to photon-photon collisions, are considered: deep inelastic Compton scattering, and photon pair production. The relevant theoretical and experimental literature is reviewed.

45512 (LYCEN—8460) **Elastic slopes and diffraction.** Giffon, M.; Predazzi, E. . (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Sep 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752042.

It is well known that elastic hadronic slopes grow with energy and appear sizeably larger when measured very close to t=0 than at intermediate t-values. This has been confirmed by the recent anti-p p measurements at the CERN SPS-Collider. By comparing the data with a formula derived recently which gives the slope as a function of the four momentum transfer squared t and of the average multiplicity <N> we argue that all the basic properties of hadronic slopes may be attributed to the role of multiparticle unitarity, i.e. to diffraction.

45513 (NIKHEF-H—84-14) **Remarks on nucleon-nucleon hard scattering.** Wolters, G.F. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Oct 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701927.

Spin asymmetry and correlation parameters for elastic nucleon-nucleon scattering at high psub(T)^2 are considered. Helicity non-conservation is not found to be important at 90°sub(CM) in the medium energy range. The only proposed explanation of large asymmetry in pp scattering, available at present, runs short in confrontation with experimental evidence.

45514 **(NIKHEF-H—84-15) Two-loop large Higgs mass corrections to vector boson self-couplings.** Bij, J.J. van de. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Oct 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701922.

The two-loop corrections to the three-vector boson vertices are calculated in the limit of large Higgs mass. Corrections growing quadratically with the Higgs mass appear in the anomalous magnetic moment of the charged vector boson and the corresponding $W_0W^+W^-$ coupling. Also the weak coupling constant in the $W_0W^+W^-$ vertex receives a correction compared to the coupling in β-decay. The results suggest a break-down of perturbation theory for a Higgs mass of 3.4 TeV and larger.

45515 **(SI—82-12) Infrared regularization dependence of the asymptotic behavior of the Sudakov form factor in QCD.** Ohrndorf, T. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). 1982. 24p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

We report the results of an explicit calculation of the leading contributions including O(asub(s)^3) corrections to the asymptotic behavior of the quark form factor in QCD in the limit of large virtual mass of the photon. In contrast to previous investigations we regularize infrared singularities by keeping either one (ON/OFF), or both quarks (OFF) off shell, or both quarks on shell (ON) and employing dimensional regularization in addition. Up to the investigated order our final result is represented by the beginning of an exponential series, no matter which regularization prescription is chosen. We give a representation which comprises the three limits of the form factor in a uniform manner.

45516 **(SI—84-3) Spinless bosons in electron-positron annihilation.** Bopp, F.W.; Brandt, S.; Dahmen, H.D.; Schiller, D.H.; Waehner, D. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). 1984. 42p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

The contribution to the processes $e^+e^- \to \mu^+\mu^-$, q anti q, $\gamma\gamma$, e^+e^- mediated by scalar and/or pseudoscalar bosons are calculated. The constraints on their coupling constants and their masses are investigated as they arise from the radiative decay $Z^0 \to e^+e^-\gamma$ and from the experimental data for the annihilation processes into lepton, photon and quark pairs. Data on $e^+e^- \to \mu^+\mu^-$, $\gamma\gamma$ and e^+e^- seriously reduce the domain of coupling constants to leptons and photons still allowed by the probable value of the width of $Z^0 \to e^+e^-\gamma$. Experiments $e^+e^- \to \mu^+\mu^-$, $\gamma\gamma$, e^+e^- at 45 GeV c.m.s. energy with a sensitivity of 10% will decide about the existence of a heavy spinless boson with the presumed phenomenological couplings to leptons and photons. Assuming universality of the coupling to leptons and quarks a conservative bound on the contribution to R arising from spinless boson exchange is already in conflict with the presumed radiative width of $Z^0 \to e^+e^-\gamma$. (The extension of this preprint compared to the previous version of Si-83-24 consists mainly in the inclusion of Bhabha scattering.) (orig.).

45517 **(SI—84-9) Sudakov form factor beyond the leading logarithmic approximation.** Ohrndorf, T. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). Jul 1984. 67p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

We present the general form of the asymptotic behavior of the massless electron-photon vertex function in quantum electrodynamics in the limit where q^2, the virtual mass of the photon, becomes large. All the logarithms in q^2 are taken into account, whereas inverse powers of q^2 are neglected. In contradistinction to previous investigations we consider the off-shell vertex function and work in the Feynman gauge. Extensive use is made of the α-representation of Feynman integrals.

45518 **(UWThPh—85-02) Decay of the top-quark.** Klein, M.; Pietschmann, H.; Rupertsberger, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701925.

T-decay life-time is related to the Kobayashi-Maskawa matrix elements in the free quark model as well as in a semi-phenomenological approach. The semi-leptonic branching ratio is also given.

45519 **(UWThPh—85-07) CP violation and left-right symmetry.** Ecker, G.; Grimus, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1985. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701928.

We investigate minimal L-R symmetric gauge models with spontaneous CP violation. The effective 'ΔS'=1.2 Hamiltonians are calculated giving special attention to a careful evaluation of QCD corrections. Two classes of models are distinguished by the sign of the L-R contribution Δmsup(LR)sub (Ksub(L)Ksub(S)) to the Ksub(L)Ksub(S) mass difference. Requiring 'Δmsup(LR)sub (Ksub(L)Ksub(S)) ' <= Δmsup(exp)sub (Ksub(S)Ksub(L)) leads to the lower bounds M_3 greater than or approximate 2.5 TeV, Msub(H) greater than or approximate 10 TeV for the heavy charged vector boson and neutral Higgs mass, respectively. Epsilon, epsilon' and the neutron electric dipole moment dsub(n) are computed in the small-phase approximation. The experimental value of epsilon can be reproduced with M_3 in the several TeV range. Epsilon'/epsilon may have either sign and is strongly correlated with dsub(n). Depending on the sign of Δmsup(LR)sub (Ksub(L)Ksub(S)), we find 'epsilon'/epsilon' less than or approximate (4 or 6) x 10^{-3} and 'dsub(n)' less than or approximate (4 x 10^{-25} or 3 x 10^{-26}) e. cm.

45520 **(UWThPh—85-09) Decay of heavy quarks.** Pietschmann, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1985. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701929.

The decay of heavy quarks (b and t) is studied with the help of spectral functions. As much information as possible is taken directly from experiment. Older computations in the free quark approximation are supported. This is important for the extraction of Kobayashi-Maskawa matrix elements from experiments.

45521 **Coupling charmonium to the charmed-meson sector.** Jaronski, W.S.; Robson, D. (Department of Physics, Florida State University, Tallahassee, Florida 32306). *Physical Review [Section] D: Particles and Fields;* **32**: No. 5, 1198-1204(1 Sep 1985).

The cc-bar states of charmonium are coupled by means of the pair production of light quarks to charmed-meson states. The coupling operator is derived from a reduction of the Feynman amplitude for pair production. The potential and wave functions used are those of the Stanley-Robson model. Energy shifts for the first three J/sup P/ = 1^- states are found to be in the range 50—80 MeV downward. The calculated width of the state psi''(3770) is 14 MeV, which compares favorably with the observed value. Extension of these calculations to lighter and heavier meson systems is briefly considered in the concluding section. Suggestions for improvements and possible areas for further study are also given.

45522 **D/sup / decays: Do theory and experiment agree?.** Thews, R.L.; Kamal, A.N. (Department of Physics, University of Arizona, Tucson, Arizona 85721). *Physical Review [Section] D: Particles and Fields;* **32**: No. 3, 810-812(1 Aug 1985). Contract AC03-76SF00515.

We study the hadronic and radiative decays of D/sup asterisk+/ and D/sup asterisk0/. Using SU(4) symmetry for the hadronic decays, we convert the branching ratios into total rates for D/sup asterisk+/ and D/sup asterisk0/. We point out a potential problem with the ratio Γ(D/sup asterisk+/→$D^+\pi^0$)/Γ(D/sup as-

terisk+/→D $^{0}\pi^{+}$). Finally, using the measured branching ratios for radiative decays, we extract the "experimental" radiative rates. We find these radiative rates puzzling as they are difficult to understand in an SU(4) or broken-SU(4) scheme.

45523 **Gluinonium: The hydrogen atom of supersymmetry.** Goldman, T. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.); Haber, H.E. (California Univ., Santa Cruz (USA). Dept. of Physics). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 181-196(Jan 1985).

The "gluino" (g tilde) the Majorana spin-1/2 supersymmetric partner of the gluon, behaves like a new quark flavor which is a color octet. In analogy with quarkonium, there should exist a spectrum of g tilde g tilde bound states which we will call gluinonia. The large color charge leads to enhanced production rates (in both singlet and octet gluinonia states) in gluon-gluon scattering processes. We compute the rate for observing gluinonium in quarkonium decay and in high energy hadronic collisions. The signal-to-noise ratio is small, but may be observable. The non-observation of a pseudoscalar gluinonium state in radiative psi decay probably rules out gluino masses less than 1 GeV/c^2.

45524 **Bound-state effects in Y -> γ+ resonance.** Pantaleone, J.; Tye, S.H.H. (Cornell Univ., Ithaca, NY (USA). Lab. of Nuclear Studies); Peskin, M.E. (Stanford Linear Accelerator Center, CA (USA)). *Physics Letters,* [*Section*] *B;* **149**: No. 1-3, 225-233(13 Dec 1984).

We study the effect of b-b^{-} bound state dynamics on the amplitude for the reaction T -> γ + resonance. We argue from our results that the recently discovered zeta (8320) must have a scalar, rather than a pseudoscalar, coupling to the b quark.

45525 **Approach of p anti p and pp elastic scattering to 'asymptopia'.** Block, M.M. (Northwestern Univ., Evanston, IL (USA)); Cahn, R.N. (Lawrence Berkeley Lab., CA (USA)). *Physics Letters,* [*Section*] *B;* **149**: No. 1-3, 245-252(13 Dec 1984).

We have previously made a model-free analysis of the t=0 amplitude for p anti p and pp elastic scattering using data in the energy region $5 < \sqrt{s} < 62$ GeV. We use our high-energy values of sigmasub(tot) and rho to fix the energy dependence of the Chou-Yang model of elastic scattering and compute the differential elastic scattering cross sections, dsigmasub(n) / dt, at large -t. In this note, we show that this model, which is dominated at low energies by the matter distribution of the p anti p (pp) system, goes over at SSC energy, 40 TeV, essentially into a structureless black disk. The curvature parameter, $C=(1/2)d^2[\log(d\sigma/dt)]/dt^2$ at t=0, is a sensitive indicator of this transition to 'asymptopia', being positive at ISR energies, going through zero near $\sqrt{s}$=2TeV (the tevatron collider), and becoming very negative at $\sqrt{s}$=40 TeV (the SSC), where the predictions for the Chou-Yang model are hardly distinguishable from those for a sharp disk, after the diffraction have been filled in by the contribution of the real part.

45526 **Heavy flavour contributions to massive lepton pair production.** Berger, E.L. (European Organization for Nuclear Research, Geneva (Switzerland); Argonne National Lab., IL (USA). High Energy Physics Div.); Soper, D.E. (Oregon Univ., Eugene (USA). Inst. of Theoretical Science). *Nuclear Physics* [*Section*] *B;* **247**: No. 1, 29-43(3 Dec 1984).

Massive lepton pair production in hadronic collisions, A + B -> $\mu^{+}\mu^{-}$X, is usually assumed to proceed via an intermediate virtual photon, γsup(*) -> $\mu^{+}\mu^{-}$, the Drell-Yan process. We examine other contributions arising from heavy flavour production, A + B -> Q anti QX; Q -> $\mu\nu$X. We find that this background is comparable to the Drell-Yan signal at small values of M^2sub(μ)sub(anti μ)/s but negligible at large values. Characteristic signatures are described that distinguish the background from the signal.

45527 **Theoretical study of parton fragmentation and evolution into hadrons.** Ng, A.H. Ames, IA; Iowa State Univ. (1984). 192p. University Microfilms Order No. 85-05,855.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Jet production via the QCD Compton effect $\gamma q \rightarrow gq$ are investigated by using Monte Carlo methods to simulate complete three jet events for photo-nucleon interactions. This process provides unique possibilities for jet studies because the incoming photon transfers its entire energy to the final state gluon and quark jets. The authors present a number of predictions for photons in the range of energies presently available up to Tevatron energies and find that the QCD Compton effect will dominate over vector meson dominance at large gluon transverse momenta.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 45014, 45330, 45464, 45472, 45473, 45474, 45475, 45476, 45477, 45551, 45770

45528 **(CNRS-CPT—84-P-1664) Are gauge symmetries symmetries.** Horvathy, P.A.; Rawnsley, J.H. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Oct 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752071.

In topologically non-trivial gauge theories there is in general an obstruction for implementing gauge transformations on the fields, and even those which can be implemented may fail to be symmetries. For instantons no non-trivial gauge transformation can be implemented. For a monopole the residual symmetry group G is implementable if the projection onto the centre of its non-Abelian charge Q is quantized. G is however a symmetry group only if Q belongs actually to the centre. In the non-Abelian Bohm-Aharonov experiment all gauge transformations are implementable but they are symmetries only if the enclosed flux is quantized.

45529 **(CNRS-CPT—84-PE-1661) Survival of grand unified monopoles.** Horvathy, P.A.; Rawnsley, J.H. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Oct 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752070.

If a grand Unified Theory with a compact unifying group G is spontaneously broken to H, magnetic monopoles are created. The fate of such an H-monopole under a subsequent breaking to K is contained in H is shown to depend on the behaviour of its non-Abelian charge Q introduced by Goddard, Nuyts, Olive: if Q belongs to the Lie algebra k of K, the monopole survives: if Q can be H-rotated to k, it can be converted. A necessary condition for an H-monopole to survive is that its Higgs charge satisfy a topological constraint.

45530 **(DESY—85-023) Noethers theorem in quantum field theory.** Buchholz, D.; Doplicher, S.; Longo, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752092.

Extending an earlier construction of local generators of symmetries in (S. Doplicher, 1982) to space-time and supersymmetries, we establish a weak form of Noethers theorem in quantum field theory. We also comment on the physical significance of the 'split property', underlying our analysis, and discuss some local aspects of superselection rules following from our results.

45531 (INIS-mf—9489, pp 327-339) **Pattern of chiral symmetry breaking in quantum chromodynamics.** Konishi, K. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Arguments of Coleman and Witten are generalized to show that the possible pattern of chiral symmetry breaking in QCD is SU(Nsub(f)) x SU(Nsub(f)) x Usub(V)(1) - SUsub(V)(Nsub(f)) x Usub(V)(1), under reasonable assumptions. Chiral symmetry breakdown is itself assumed. (author).

45532 (INIS-mf—9489, pp 341-345) **Chiral symmetry and bag model.** Szymacha, A. (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej); Tatur, S. (Polska Akademia Nauk, Warsaw. Centrum Astronomiczne). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

In SU(2) x SU(2) model basic parameters and radii of bag as well as all electroweak properties of nucleons are calculated. In the calculations the corrections due to the centre of mass motion analyzed earlier by Donoghuse and Johuson were taken into account. The assumptions only one pion emission and pion self-interactions were done. (I.L.).

45533 (INIS-mf—9489, pp 347-362) **Patterns of CP violation.** Peccei, R.D. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The experimental and theoretical constraints on models of CP violation are discussed. The predictions of the hard CP-violating Kobayashi-Maskawa model are contrasted with those of a left-right model, where CP is broken spontaneously. A brief discussion is included of the difference between the CP-violating phases that enter in kaon decay and those that may be responsible for the baryon asymmetry in the Universe. (author).

45534 (INIS-mf—9489, pp 403-406) **Higgs fields in M.A.C.** Czechowski, A. (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Assuming the symmetry SU(N) of gauge field the symmetry breaking pattern is given and it is shown that it is possible fo find the eigenvalue-type asymptotically free solutions with fundamental scalars in the most attractive channel. (L.I.).

45535 **(INIS-mf—9489) Proceedings of the 4. Warsaw symposium on elementary particle physics. Kazimierz, Poland, 24-31 May 1981.** Ajduk, Z.; Doroba, K. (eds.). (Warsaw Univ. (Poland). Inst. Fizyki Teoretycznej; Institute of Nuclear Research, Warsaw (Poland)). 1981. 525p. (CONF-8105114—). NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516.

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Individual papers in this proceedings are separately indexed. (LEW)

45536 **(INP—1131/PL) Problem of the additional quantum number ω in the decomposition U(3) x U(3) → U(3).** Knyr, V.A.; Smirnov, Yu. F.; Tolstoy, V.N. (Institute of Nuclear Physics, Krakow (Poland)). 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701936.

The matrix of the operator OMEGA = Σsub(i,k,l) Asub(ik)(v)Asub(kl)(v) Asub(li)(w) (Asub(ik) are the generators of the U(3) group) exhibits a nondegenerate spectrum of the eigenvalues ω which may be used as the additional quantum number for the complete and unambiguous classification of the basic vectors in the space of the direct product of the irreducible representations D[v] x D[w] of the U(3) group.

45537 **(IPNO-TH—83-34) Pauli-Guersey symmetry in gauge theories.** Stern, J. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). May 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751162.

Gauge theories with massless or massive fermions in a self-contragredient representation exhibit global symmetries of Pauli-Guersey type. Some of them are broken spontaneously leading to a difermion Goldstone bosons. An example of a boson version of the Pauli-Guersey symmetry is provided by the Weinberg-Salam model in the limit THETAsub(w)→O.

45538 **(IPNO-TH—84-15) Contribution to the study of spontaneous breakdown of the chiral symmetry in gauge theories.** Gamonal, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-6 Univ., 75 (France)). 1984. 143p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85751171.

In the framework of quantum chromodynamics, we have been interested in the order parameters for the breakdown of the non-abelian chiral symmetry. Using the functional integral representation in the euclidean formalism, we have performed the fermionic integration after having inverted the chiral limit and the integration over gluonic fields. So, we were led to look for what gauge field configurations, the fermionic integrand has a non-vanishing chiral limit. We have been able to show, in a general manner, that the generating functional of all the order parameters vanishes in the chiral limit for the gauge field configurations which lead to a discrete spectrum for the Dirac operator around zero. For those leading to a continuous spectrum from the zero eigenvalue, the existence of a non-vanishing infra-red limit for the spectral density of the Dirac operator is crucial. We have exhibited gauge field configurations which give such a behaviour. Nevertheless, our analysis reveals the necessity to get a degeneracy for the zero modes belonging to the continuum of the Dirac operator. We have been able to demonstrate, for the class of gluonic fields, previously considered, an absence of degeneracy.

45539 **Fermion mass hierarchy as a consequence of the spontaneous breakdown of the four-flavor symmetry.** Cveti, M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **32**: No. 5, 1214-1221(1 Sep 1985). Contract AC03-76SF00515.

We study the fermion mass matrix in the case of four fermionic flavors u, d, c, and s. The original Lagrangian of the effective gauge theory respects the full four-flavor symmetry and fermions are massless. We analyze a vacuum expectation pattern of the elementary Higgs-field multiplet Phi/sub a/b [(a,b) = u,d,c,s]. Nonzero vacuum expectation values of Phi spontaneously break the original flavor symmetry with fermionic masses being directly proportional to these vacuum expectation values. In the Higgs potential, hard terms in Phi respect the global symmetry SU(4)/sub L/ x SU(4)/sub R/ of four flavors while soft terms in Psi break this symmetry down to the effective anomaly-free gauge group SU(2)/sub L//sup e/+μ x SU(2)/sub R//sup e/+μ. These soft terms are due to radiative as well as nonperturbative effects. Such a symmetry structure of the Higgs potential can be motivated by the underlying preonic dynamics. The desired solution, i.e., the proper interfamily and intrafamily hierarchy as well as the desired Cabibbo mixing angle, can emerge as a consequence of a subtle interplay between the soft terms and certain hard terms of the Higgs potential.

45540 **Supersymmetric statistical models on the lattice.** Shapir, Y. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.; Illinois Univ., Urbana (USA). Materials Research Lab.). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 129-137(Jan 1985).

SUSY models in statistical mechanics involve spinless fermions and form an ideal laboratory for latticization. Extension of SUSY relations to the lattice may clarify, as well, the question of their validity beyond perturbation theory. A non-linaer approach to lattice SUSY is introduced by the assignment of coupled commuting and anticommuting variables to each lattice site. As a typical example we demonstrate a SUSY dimer Hamiltonian which generates lattice branched-polymer configurations. We suggest a new SUSY model whose configurations are generated by the Ising super-Hamiltonian. These configurations cannot be simply related to the high temperature expansion of the random-field Ising model. The critical behavior of the random-field model is probably in the non-perturbative regime with thermal fluctuations squeezed into anti d-dimensional manifolds in the boundaries of frozen domains. SElf-consistent dimensional reductions yields anti d = (d + 1/ν)/2 if α < 0 and anti d = d - 1/ν if α > 0, where d is the actual

spatial dimension and α and ν are the critical exponents for the specific heat and correlation length, respectively. This may be explained in terms of anomalous "anticommuting dimensions".

45541 Review of supersymmetric quantum mechanics. Freedman, B. (Illinois Univ., Urbana (USA). Dept. of Physics); Cooper, F. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 138-146(Jan 1985).

In this survey we review both the Hamiltonian and the path-integral approaches to supersymmetric quantum mechanics. We then discuss the related path integrals for the Witten index and for stochastic processes and show how they are indications for supersymmetry breakdown. We then discuss a system where the superpotential W(x) has asymmetrical values at x=+-infinite. In this case, we find that pairing is broken as there is a mismatch between the fermionic and bosonic continuum density of states. Also, the Witten index is dependent on the regulation parameter β. We finally discuss nonperturbative strategies for studying supersymmetry breakdown based on introducing a lattice and studying the behavior of the ground state energy as the lattice cutoff is removed.

45542 Supersymmetry breaking at finite temperature and the existence of the Goldstone fermion. Boyanovsky, D. (Stanford Linear Accelerator Center, CA (USA)). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 152-162(Jan 1985).

In this article we attempt to understand the nature of SUSY breaking at finite temperature and to determine whether or not there is a Goldstone fermion associated with this phenomenon. We use a manifestly Lorentz covariant formalism to study the theories under consideration; this is necessary to expose fully the dynamical properties of physical observables. It is shown that in this way Goldstone excitation is found as a consequence of the breaking at finite temperature, and it becomes clear how this excitation decouples at zero temperature. The rest of the article is devoted to the technical details of the investigation and is divided as follows: in section 2 the standard Ward identities at zero temperature are briefly reviewed. In section 3 the finite temperature formalism are reviewed, exposing the differences between the covariant (real time) and non-covariant (imaginary-time) formulations. The results of section 2 will be extended to finite temperature in the covariant approach. Section 4 is devoted to the computation of the fermion thermal Green's exposing the mechanism that gives rise to the Goldstone pole and the way it decouples at zero temperature. The conclusions are summarized at the end of the article.

45543 Superlattice supersymmetry. Kostelecky, V.A. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.); Rabin, J.M. (Chicago Univ., IL (USA). Enrico Fermi Inst.). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 213-218(Jan 1985).

We construct a cubic lattice of discrete points in superspace, as well as a discrete subgroup of the supersymmetry group which maps this "superlattice" into itself. We discuss the connection between this structure and previous versions of lattice supersymmetry. Our approach clarifies the mathematical problems involved in formulating supersymmetric lattice field theories and suggests new methods for attacking them.

45544 Nonlinear realizations and the partial breaking of extended supersymmetry. Bagger, J.A. (Stanford Linear Accelerator Center, CA (USA)). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 198-207(Jan 1985).

In this paper we use nonlinear realizations to examine the breaking of N=2 extended supersymmetry to N=1. We derive Lagrangians and transformations laws for the generalized N=2 Akulov-Volkov Goldstone field. We analyze the ghost states and show that they may be collected into N=1 supermultiplets. We extend the transformation laws for the N=1 chiral and vector multiplets to N=2. Finally, we give the N=2 generalization of an arbitrary N=1 supersymmetric Lagrangian.

45545 Stability of supersymmetric ground state in chiral theories. Taylor, T.R. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters, [Section] B;* **149**: No. 6, 470-472(27 Dec 1984).

The effective action for the scalar propagator is studied in supersymmetric chiral gauge theories. The form of the scalar potential ensures the stability of the supersymmetric ground state, even for large values of the coupling constant. It is found however, that the gluino condensation tends to destabilize the system. This may signal dynamical supersymmetry breaking.

6454 Field Theory

REFER ALSO TO CITATION(S) 45457, 45521, 45535, 45540, 45541, 45542, 45543, 45545, 45763, 45770

45546 (BNL—36727) Reversible Ising dynamics. Creutz, M. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 8p. (CONF-8504167—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016059.

From Conference on advances in lattice gauge theory; Coral Gables, FL, USA (10 Apr 1985).

The author discusses a reversible deterministic dynamics for Ising spins. The algorithm is a variation of microcanonical Monte Carlo techniques and is easily implemented with simple bit manipulation. This provides fast programs to study non-equilibrium phenomena such as heat flow.

45547 (CNRS-CPT—84-P-1622) Remark on the cluster theorem. Fredenhagen, K. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jun 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751169.

An improved version of the cluster theorem of relativistic quantum field theory with the correct exponential decay is derived by function theoretical methods.

45548 (DESY—85-026) Iterative hopping expansion algorithm for Monte Carlo calculations with very light fermions. Montvay, I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752128.

The number of numerical operations necessary for a Monte Carlo simulation with very light fermions (like u- and d-quarks in quantum chromodynamics) is estimated within the iterative hopping expansion method.

45549 (DESY—85-027) Kadanoff-Wilson transformations in quantum gauge theories. Kerler, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752129.

A transparent condition restricting KW transformations of correlation functions is used to establish the behavior of QFT functions. The arising proportionality factors are calculated for large classes of transformations and correlations. Gauge-invariant block transformations for matter fields are introduced, too. KW invariant functions are constructed which are suited for the QFT limit and allow firm conclusions about the parameters of the theory.

45550 (DESY—85-031) Classical instanton on a 4-dimensional periodic lattice. Fox, I.A.; Laursen, M.L.; Schierholz, G.; Gilchrist, J.P.; Goeckeler, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752133.

On a 4-dimensional periodic lattice, we construct an SU(2) gauge field configuration which is analogous to the classical instanton. This is shown to have topological charge equal to one. We calculate the eigenvalue spectrum of the fermion matrix and demonstrate the existence of an approximate zero-mode.

45551 (DOE/ER/45144—T1) [Topics in theoretical physics]. Progress report. (Chicago Univ., IL (USA)). 1985. Contract FG02-84ER45144. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016734.

Progress is reported in these areas: supersymmetry and conformal invariance and new structures in two dimensional critical phenomena; spinor fields and new applications and techniques for studying Ising model correlation factors; superstring compactification and high energy physics applications for novel two dimensional critical points; ordered and disordered spatial structure in dynamical systems; and fermion-boson mass relations in BCS type theories. Research is proposed in covariant formulation of the superstring, topics in superconformal field theory and new structures in two dimensional critical phenomena, ordered and disordered spatial structure in dynamical systems, and field theory over Galois fields. 48 refs. (LEW)

45552 **(FRNC-TH—1569) Renormalisation and completely integrable theory.** Maillet, J.M. (Paris-11 Univ., 91 - Orsay (France)). Mar 1982. 112p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85751150.

In this work the following questions are treated: S matrix factorizable and statistical models; classical method of inverse problem; quantum complex model of Sine-Gordon.

45553 (INIS-mf—9306, pp I47) **Unitarity and time reversal in the Glauber model.** Lazard, C.; Lombard, R.J. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique); Maric, Z. (Belgrade Univ. (Yugoslavia). Inst. za Fiziku). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45554 (INIS-mf—9489, pp 263-274) **Lattice gauge theory.** Itzykson, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Various aspects of lattice gauge theory such as lattice quantization, strong coupling expansions and mean field approximation are presented. A method of producing new results by including fermions into the theory is also described. (I.L.).

45555 (INIS-mf—9489, pp 299-305) **Gluon condensate from lattice caculations: SU(3) pure gauge theory.** Kripfganz, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

A short distance expansion of Wilson loops is used to define and isolate vacuum expectation values of composite gluon operators. It is applied to available lattice Monte Carlo data for SU(3) pure gauge theory. The value obtained for the gluon condensate is consistent with the ITEP estimate. (author).

45556 (INIS-mf—9489, pp 363-381) **Oasis in the desert: weakly broken parity in grand unified theories.** Senjanovic, G. (European Organization for Nuclear Research, Geneva (Switzerland); Brookhaven National Lab., Upton, NY (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

A discussion of low energy parity restoration in simple grand unified theories, such as SO(10), is presented. The consistency of phenomenological requirements and unification constraints is emphasized and various predictions of the theory are stressed, in particular: substantially lighter W and Z bosons than in the standard model and increased stability of the proton with tausub(p) approximately equal to 10^{36} years. (author).

45557 (INIS-mf—9489, pp 275-282) **Gribov copies and instantons.** Nahm, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Gribov copies are closely related to instanton effects. Thus they are of semi-classical nature and have nothing to do with confinement.

45558 (INIS-mf—9489, pp 307-326) **Symmetry breaking at high temperature.** Senjanovic, G. (European Organization for Nuclear Research, Geneva (Switzerland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

Review of the arguments for symmetry non-restoration at high temperature is presented. The consequences for the baryon number of the Universe; monopole problem in grand unified theories and horizon problem in the standard cosmological model are discussed.

45559 (INIS-mf—9489, pp 407-425) **Perturbative QCD beyond "classical" problems.** Kalinowski, J.; Para, A.; Pokorski, S. (Warsaw Univ. (Poland). Wydzial Fizyki). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

We review two topics: present status and prospects in studying gluon properties, and event structure in the hadronic final states.

45560 **(INIS-mf—9756) Two-loop renormalization of general quantum field theories.** Damme, R.M.J. van. (Rijksuniversiteit Utrecht (Netherlands)). 29 Oct 1984. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85781535.

Includes Dutch summary; 58 refs.; 7 figs.; 2 tabs.

This thesis provides a general method to compute all first order corrections to the renormalization group equations. This requires the computation of the first perturbative corrections to the renormalization group β-functions. These corrections are described by Feynman diagrams with two loops. The two-loop renormalization is treated for an arbitrary renormalization field theory. Two cases are considered: 1. the Yukawa sector; 2. the gauge coupling and the scalar potential. In a final section, the breakdown of unitarity in the dimensional reduction scheme is discussed.

45561 **(IPNO-TH—83-54) Order αsub(s) corrections to nucleon axial form factors in the bag model.** Loiseau, B.; Maxwell, O.V.; Cottingham, W.N. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751160.

In this paper, we demonstrate a consistent procedure for renormalization in Q.C.D. perturbation theory inside the bag and calculate up to order αsub(s) the nucleon axial form factors for small values of q^2. Our gluonic corrections for the axial vector form factor are small but improve the agreement of the zeroth order result with experiment. Our calculated induced pseudoscalar form factor is much smaller than experiment which appears to be dominated by the pion pole, we take this as evidence that the pion field around a nucleon can not be generated in low order Q.C.D. perturbation theory.

45562 **(JINR—E-2-84-260) Intrinsic geometry of N=2 supersymmetry and supergravity.** Galperin, A.; Ivanov, E.; Kalitzin, S.; Ogievetsky, V.; Sokatchev, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 6p. (CONF-840757—34). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701919.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

A new approach to N=2 supersymmetry based on the concept of harmonic superspace is proposed and used to give an unconstrained superfield geometric description of N=2 super Yang-Mills and supergravity theories as well as of matter N=2 hypermultiplets. The harmonic N=2 superspace has as independent coordinates, in addition to the usual ones, the isospinor harmonics U_i^{+-} on the sphere SU(2)/U(1). The role of usub(i)sup(+-) is to relate the SU(2) group realized on the component fields to a U(1) group acting on the relevant superfields. Their introduction makes it possible to SU(2)-covariantize the notion of Grassmann analyticity. Crucial for this construction is the existence of an analytic subspace of the general harmonic N=2 superspace. The hypermultiplet superfields and the true prepotentials (pre-prepotentials) of N=2 super Yang-Mills and supergravity are unconstrained superfunctions over this analytic subspace. The pre-prepotentials have a clear geometric interpretation as gauge connections with respect to the internal SU(2)/U(1) - directions. A radically new feature arises: the number of gauge and auxiliary degrees of freedom becomes infinite while the number of physical degrees of freedom remains finite. Other new results are the massive N=2 Yang-Mills theory and various off-shell self-interactions of hypermultiplets. The propagator for Yang-Mills superfield is given.

45563 **(NIKHEF-H—84-12) Analytical evaluation of the partition function for unit hypercubes in four dimensions.** Hari Dass, N.D. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Oct 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701920.

The group integrations required for the analytic evaluation of the partition function for unit hypercubes in four dimensions are carried out. Modifications of the graphical rules for SU_3 group integrations cited in the literature are developed for this purpose. A complete classification of all surfaces that can be embedded in the unit hypercube is given and their individual contribution to the partition function worked out. Applications are discussed briefly.

45564 **(NIKHEF-H—84-13) Variational estimates for the mass gap of SU(2) Euclidean lattice gauge theory.** Hari Dass, N.D. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Oct 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701918.

The purpose of this letter is to report on the progress made in our understanding of series expansions for the masses in lattice gauge theories by the application of variational techniques to the Euclidean SU(2) lattice gauge theory.

45565 **(UFPB-DF—02/84) Supersymmetry-supergravity.** Oliveira Rivelles, V. de. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701921.

A short introduction to supersymmetry and supergravity is made. The utilization of finite field theories and some new advances in particle phenomenology and cosmology are presented.

45566 **Quark mass matrices in a SUSY composite model.** Zhou, B.R. (China Univ. of Science and Technology, Hofei. Dept. of Modern Physics; Stanford Linear Accelerator Center, CA (USA)); Lucio, J.L. (Instituto Politecnico Nacional, Mexico City. Dept. de Fisica; Instituto Politecnico Nacional, Mexico City. Centro de Investigacion y de Estudios Avanzados). *Physics Letters, [Section] B;* **149**: No. 1-3, 152-156(13 Dec 1984).

It is shown that the Z_{10} symmetry which survives the breaking of a combination of the axial Usub(A)(1) and the R symmetry in a SUSY composite model, can lead to the relation tg THETAsub(c) approx.= (msub(d) / msub(s))sup(1/2).

45567 **Conservation of electric charge around a monopole of finite size.** Kazama, Y. (Kyoto Univ. (Japan). Dept. of Physics); Sen, A. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] B;* **247**: No. 1, 190-224(3 Dec 1984).

In monopole-fermion dynamics, the boundary condition which is responsible for baryon number non-conservation also violates electric and color hypercharge conservation. We show by detailed calculations that actually the latter conservation laws are dynamically restored. It is shown that for a finite size monopole, there is a small but finite amplitude for the monopole ground state to make a virtual transition into a state containing a dyon and some fermions carrying equal and opposite charge as that of the dyon. But the amplitude for this state to make a virtual transition to a state carrying a net total charge is identically zero. The monopole ground state, as a result, is an eigenstate of electric charge even in the presence of massless fermions. We also calculate the four-body charge and chirality conserving but baryon number violating condensates, which exist independently of the existence of the anomaly and hence persist even in the presence of more generations of massless fermions.

6455 Scattering Theory

45568 **(UWThPh—84-45) Quasi-classical limit of scattering amplitude - L^2-approach for short range potentials.** Yajima, K. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1984. 64p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701914.

We are concerned with the asymptotic behaviour as Planck's constant $h \to 0$ of the scattering operator Ssup(h) associated with the pair of Schroedinger equations i h/2π delta u/delta t = - ((h/2π)^2/2m)Δu + V(x) u equivalent to Hsup(h)u and i h/2π delta u/delta t = - ((h/2π)^2/2m)Δu equivalent to Hsup(h)$_0$u. We shall show under certain conditions that the scattering matrix S-circumflexsup(h)(p,q), the distribution kernel of Ssup(h) in momentum representation, may be expressed in terms of a Fourier integral operator. Then applying the stationary phase method to it, we shall prove that S-circumflexsup(h) has an asymptotic expansion in powers of h/2π up to any order in L^2-space and that the limit as $h \to 0$ of the total cross section is twice the one of classical mechanics, in generic.

65 PHYSICS II

REFER ALSO TO CITATION(S) 45322

45589 **(AD-A—154995/5/XAB) Kalman-Filter time-series analysis of gamma-ray data from NaI(Tl) detectors for the ND6620 computer. Final report.** Phillips, G.W. (Naval Research Lab., Washington, DC (USA)). 8 May 1985. 117p. (NRL-MR—5541). NTIS, PC A06/MF A01.

The Kalman-Filter technique is applied to time-series gamma-ray data from NaI(T1) detectors. A set of standard spectra that contribute significantly to the data in the least-squares sense are first determined using regression analysis. The Kalman-Filter computer program is then used to determine the time behavior for the intensities of the standards that contribute to the observed spectra. The program was written for the ND6620 computer in DEC RT-11 FORTRAN and is being transferred to the VAX 11/780.

6510 Nuclear Physics

45570 (IAEA-SMR—93, pp 173-206) **Evaluation of nuclear data and their uncertainties.** Story, J.S. (UKAEA Atomic Energy Establishment, Winfrith). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Some topics studied within the Winfrith Nuclear Data Group in recent years, and still of current importance, are briefly reviewed. Moderator cross-sections; criteria to be met for reactor applications are listed; thermal neutron scattering theory is summarized, with the approximations used to facilitate comutation; neutron age data test stringently the accuracy of epithermal cross-sections; a modification of the CFS effective range treatment for S-wave scatter by H is presented, and new calculations with up-to-

date slow neutron scattering data are advocated. Use of multilevel resonance formalisms; the top bound resonance should be included explicitly in calculations; additive statistical terms are given to allow for "distant" negative and positive resonances, in both MLBW and R-M formalisms; formulae are presented for estimating R-M level shifts for $1 > 0$ resonances. Resonance mean spacings; the Syson-Mehta optimum estimator is utilised in a method which up-dates the staircase plot. Resonances of ^{56}Fe have been resolved to approx. 800keV, over which range the level density for given $J\pi$ should increase 2-fold; this variation is allowed for in the mean spacing calculations. Fission-product decay power; present status of integral data and summation calculations for ^{235}U and ^{239}Pu fissions is summarized, with a variety of intercomparisons including ^{239}Pu/^{235}U ratios. Data uncertainties are considered, but the sequence of data on GAMMAsub(γ) for the 27.8keV resonance of ^{56}Fe provided a cautionary example.

45571 (IAEA-SMR—93, pp 263-277) **Introduction to the content of the major available evaluated nuclear data libraries.** Salvatores, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

The following notes were intended as complement to the main topic of the lectures presented at the Winter College of Nuclear Physics and Reactors. Actually, the topic was covered according to the outline given in Appendix and the presentation was based as far as possible on the practical features of the basic data files, in particular the ENDF/B files. The present notes are subdivided in two parts: part I is a general introduction to the problem of the evaluated data files and gives the main references on the topic. Part II presents a few specific examples of the use of the evaluated data files in the wide application fields of neutron heating a photon production.

45572 (INDC(NDS)—155/G-P-No.10) **Progress in fission product nuclear data. Information about activities in the field of measurements and compilations/evaluations of fission product nuclear data (FPND).** Lammer, M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Sep 1984. 75p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701685.

This is the tenth issue of a report series on Fission Product Data which informs us about all the activities in this field which are planned, ongoing, or have recently been completed. The types of activities included are measurements, compilations and evaluations of: fission product yields (neutron induced and spontaneous fission), neutron reaction cross sections of fission products, data related to the radioactive decay of fission products, delayed neutron data of fission products, lumped fission product data (decay heat, absorption, etc.). There is also a section with recent references relative to fission product nuclear data.

45573 (INIS-mf—9306) **PANIC - particles and nuclei - tenth international conference. Book of abstracts. Vol. 2.** Guettner, F.; Povh, B.; Putlitz, G. zu (eds.). (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.; Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1984. 451p. (CONF-840789—Vol.2-Absts.). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

The second volume of the PANIC proceedings contains the abstracts contributed to the named conference concerning LEAR physics, symmetries and conservation laws, baryon reactions, relativistic heavy ion reactions, rare decays, exotic atoms, hypernuclei, and kaon reactions. See hints under the relevant topics. (HSI).

45574 (INIS-mf—9319) **Annual report 1984 of the 2. Institut fuer Experimentalphysik Universitaet Hamburg.** (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Experimentalphysik). Dec 1984. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85781550.

This annual report contains short descriptions of the work performed at the named institute together with a list of publications and theses. The work concern hyperfine structure and Moessbauer studies, synchrotron radiation experiments, contributions of this institute to the CHARM collaboration at CERN, e^+e^- interaction studies at PETRA, and detector developments.

45575 (IPNO-RA—1983) **1983. Annual progress report. [Nuclear physics research program].** (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 203p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85751177.

A beautiful experiment series for studying high energy excitation structures (10 to 80 MeV), concerning very heavy and asymmetric systems. CEV-Alice contributions to annual report concern Hg and Er high spin energy levels. About reaction mechanisms, the following contributions can be noticed: proton backward emission experiment results of high energy, at 200 MeV, on numerous targets; spectroscopic studies of direct transfer reactions by ^{18}O with measurement of angular distributions until 0°; many heavy ion experiments around 30 MeV/u concerning the mechanism evolution between 10 and 100 MeV. Pion coherent production experiments have been made this year on energy dependence of the reaction $^3He + ^3He \rightarrow {}^6Li + \pi^+$, considered as an existing model test. Cross section measurement of the elementary reactions (p,π^+) on three targets of very different masses, in a large energy scale and a wide angular domain, have been measured at the Synchrocyclotron. Concerning the nuclear structure in low and medium energy levels, elastic scattering and transfer studies are to be noticed particularly in transition nuclei region. Exotic nuclei rich in neutrons, with medium mass, Fe, Co, Ni, Zn have been studied using the ^{14}C beam of the Orsay tandem. The radiochemistry group work is essentially centered on actinides study.

45576 (JAERI-M—84-010, pp 82-96) **Review of the theory of sensitivity and uncertainty analysis.** Iijima, S. (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Kanagawa. Nuclear Research Lab.). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Theory of sensitivity and uncertainty analysis is being extensively applied to the problems in various fields, such as nuclear data evaluation, reactor physics and shielding calculations, reactor burnup problems, and thermal-hydraulics problems. It is clear that we should be familiar with this theory if we are to incorporate evaluated covariance data into JENDL Version 3. In the practical application of the theory we must deal with a large amount of input and output data and must develop detailed algorithm of calculation. Moreover, certain important problems must be cleared such as how to handle the systematic errors in data, and the uncertainties in calculational method. The present review is aimed to give essential frameworks of the theory of sensitivity and uncertainty analysis with emphasis on the application of the theory to nuclear data evaluation.

45577 (JAERI-M—84-010, pp 177-194) **Reviews of the simultaneous evaluation and evaluated covariance matrices for the cross sections on heavy nuclides.** Uenohara, Yuji; Kanda, Yukinori (Kyushu Univ., Fukuoka (Japan)). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

The simultaneous evaluation method for the cross sections on heavy nuclides are introduced on the basis of the authors' work whose features are on using of spline functions, logarithms of cross sections and Bayes estimation. The evaluated cross sections and covariance matrices for them are discussed and compared with others.

45578 (JAERI-M—84-010, pp 195-215) **Evaluation of gamma-ray production cross sections.** Mizumoto, Motoharu (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

A working group on nuclear data for photon production was organized in 1979 for the purpose of evaluating gamma-ray production cross sections for the JENDL-3 (Japanese Evaluated Nuclear Data Library-Version 3). The experimental data for evaluation and computer programs used for calculation have been accumulated and investigated. Recently, the preliminary evaluations for specific nuclei have been completed and the procedure to store the data in the ENDF/B format has been developed. This report describes the past and present activities of the working group and discusses the problems to be solved.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 44993, 45641

45579 (BONN-HE—85-1) **Photonuclear physics with low intensity photon beams.** Mecking, B.A. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jan 1985. 25p. (CONF-8410227—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751891.

From Workshop on electron and photon interactions at medium energies; Bad Honnef, F.R. Germany (29 Oct 1984).

Experiments in photonuclear physics are discussed that require a low intensity photon beam and large acceptance detectors. This combination is especially suitable for the investigation of photoprocesses on nucleons and light nuclei. A specific experimental setup for the electron stretcher ring ELSA is presented.

45580 (IAEA-SMR—93, pp 3) **Continuum spectra in proton- and neutron-induced reactions.** Tamura, T. (Texas Univ., Austin (USA). Dept. of Physics). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Published in summary form only.

45581 (JAERI-M—84-010, pp 2-14) **Introduction to nuclear cross section measurement for evaluators fission cross section.** Murata, Toru (Nippon Atomic Industry Group Co. Ltd., Tokyo). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Explanatory description of nuclear cross section measurements was made for the nuclear data evaluators who were not familiar with the experiments. Principle of the measurement, neutron sources and radiation detection techniques were explained generally at first, then examples of the measurement system, data analysis, present status of the measurement uncertainty and future problems were presented for the fission cross section measurement.

45582 (LA-UR—85-2161) **Proton polarimeters for spin transfer experiments.** McNaughton, M.W. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 19p. (CONF-8506152—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014098.

From CEBAF summer workshop; Newport News, VA, USA (3 Jun 1985).

The design and use of proton polarimeters for spin transfer (Wolfenstein parameter) measurements is discussed. Polarimeters are compared with polarized targets for spin dependent experiments. 32 refs., 4 figs.

45583 (LA-UR—85-2422) **Neutron chopper development at LANSCE.** Nutter, M.; Lewis, L.; Tepper, S.; Silver, R.N.; Heffner, R.H. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-850762—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015721.

From 8. meeting of international collaboration on advanced neutron sources; Oxford, UK (7 Jul 1985).

Progress is reported on neutron chopper systems for the Los Alamos Neutron Scattering Center pulsed spallation neutron source. This includes the development of 600+ Hz active magnetic bearing neutron chopper and a high speed control system designed to operate with the Proton Storage Ring to phase the chopper to the neutron source. 5 refs., 3 figs.

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

45584 (BONN-HE—85-06) **Tensor polarized deuteron targets for intermediate energy physics experiments.** Meyer, W.; Schilling, E. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Mar 1985. 10p. (CONF-8409134—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752085.

From 4. workshop on polarized target materials and techniques; Bonn, F.R. Germany (2 Sep 1984).

At intermediate energies measurements from a tensor polarized deuteron target are being prepared for the following reactions: the photodisintegration of the deuteron, the elastic pion-deuteron scattering and the elastic electron-deuteron scattering. The experimental situation of the polarization experiments for these reactions is briefly discussed in section 2. In section 3 the definitions of the deuteron polarization and the possibilities to determine the vector and tensor polarization are given. Present tensor polarization values and further improvements in this field are reported in section 4.

45585 (DOE/ER/02972—6) **Collaboration on medium energy measurements of N-N parameters. Progress report, January 1-December 31, 1980.** (Texas Univ., Austin (USA). Dept. of Physics). Jan 1981. Contract AC05-76ER02972. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016833.

Progress is reported in these experiments: measurement of polarization transfer coefficients K/sub NN/, K/sub LL/ in pd nX and p vector ^{9}Be → n vector X at 800 MeV, measurement of spin transfer parameters K/sub NN/, K/sub SS/ and K/sub LL/ in n vector p → p vector n at 800 MeV in the charge exchange region, measurement of the parameter D/sub NN/(90°) (=K/sub NN/(90°)) from 400 to 800 MeV in pp elastic scattering, a measurement of the deuteron spectrum in pp d($\pi\pi$)/sup O/ at 750 MeV, and pC analyzing power measurements between 550 and 800 MeV. Current approved LAMPF proposals are listed. 14 refs., 18 figs. (LEW)

45586 (INIS-mf—9306, pp I22) **P (^{3}He,t)Δ^{++} reaction.** Ellegaard, C.; Gaarde, C.; Larsen, J.S.; Peterson, R.J.; Dmitriev, V. (Niels Bohr Inst., Copenhagen (Denmark)); Goodman, C. (Indiana Univ., Bloomington (USA). Cyclotron Facility); Bergqvist, I.; Brockstedt, A.; Carlen, L.; Ekstroem, P. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45587 (ITF—84-63-R) **Excitation of breathing resonances under the S-shell nuclei scattering by α-particle.** Filippov, G.F.; Vasilevskij, V.S.; Nesterov, A.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701812.

An algorithm which allows one to take into account both collective and cluster degrees of freedom of the nucleon system is proposed for the investigation of light nuclei resonance states. The algorithm is used to study the monopole resonances of the ^{6}Li nucleus. It is shown that when deuterons collide with α-particles the

resonance states get excited at energies above 20 MeV and widths not exceeding 1.5 MeV. The collective and cluster modes coupling affecting the resonance widths is discussed.

45588 **(ITF—84-67-R) Three-body approach to the d(N, 2N)N reaction.** Kvaratskheliya, T.I.; Meboniya, D.B. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 34p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701821.

Three-body nonrelativistic approach to the quasi-elastic knock-out (QEK) reactions is developed on the basis of Faddeev equations and the assumption on validity of a single collision mechanism where the three-body unitarity for the reaction amplitude is required to be satisfied. Quantitative calculations performed for the d(P, 2P)n and d(P, Pn)P reactions together with investigations of the authors performed earlier for other (different) QEK (exhibit) the high stability of the proposed method relative to different QEK in the whole range of nonrelativistic scattering.

45589 **(ITP—84-86-E) Relativistic rotation of spin and asymptotic behaviour of the form factor of the composite system.** Trubnikov, S.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701814.

The relativistic rotation of nucleon spin in addition to deuteron spin leads to the appearance of the new term in the deuteron charge form factor (DCFF). This term is absent in the traditional approaches and essentially influences the asymptotic behaviour of DCFF. General formulae are obtained for the DCFF asymptotics in the relativistic and nonrelativistic impulse approximation.

45590 **(JINR—1-84-519) Pion absorption in the ^{4}Hep - dppn reaction.** Glagolev, V.V.; Lebedev, R.M.; Pestova, G.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701843.

The ^{4}Hep→dppn reaction at the 8.6 GeV/c momentum of ^{4}He is analysed. The difference between diagrams of dependences of effective mass of the deuteron and two slow nucleons from transfer momenta in ^{4}Hep→dppn and ^{4}Hep→^{3}Heppπ^- reactions witnesses in favour of pion absorption. It is shown that approx. 20% of the events of the ^{4}Hep→dppn reaction goes via this mechanism.

45591 **(JINR—E-1-83-690) Determination of optimal conditions for the experimental investigation of muon catalysis of nuclear reaction t+t → ^{4}He+2n.** Bystritsky, V.M.; Dzhelepov, V.P.; Gula, A.; Stolupin, V.A.; Voznyak, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701841.

Submitted to the journal Acta Phys. Pol. .

Formulae describing the kinetics of muon-catalysed fusion t+t → ^{4}He+2n in pure tritium are analyzed with the aim of establishing optimum conditions for the experimental investigation of ttsub(μ)-fusion. It is shown that to determine the parameters an experiment with a pure tritium target data have to be take at different target densities. The range of variation of target density, required to cover the region of parameter values predicted theoretically, is determined. In particular, it is shown that temperature variation of the density of liquid tritium in a rather small range above the temperature of liquid hydrogen (20.4 k) is sufficient in this kind of experiment.

45592 **(JINR—E-1-83-854) Determination of the multiple muon catalysis process parameters.** Filchenkov, V.V.; Somov, L.N.; Zinov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701823.

Submitted to the journal Sov. J. At. Energy.

The process of successive multiple muon catalysis of the t+t → ^{4}He+2n reaction is studied. In order to determine the measurements is suggested. The expressions for yield of the first, second, etc., detected acts of successive muon catalysis of experimental data and to improve the accuracy and confidence in determining the muon catalysis of d+d reaction of the mean multiplicity of this reaction m >= 1.

45593 **(JINR—E-1-84-26) Cycle-by-cycle analysis of muon catalysed fusion in a one-component medium.** Bystritsky, V.M.; Gula, A.; Voznyak, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701824.

Submitted to the journal Atomkernenerg. Kerntech. .

The formulae describing the separate cycles of muon catalysed nuclear synthesis of hydrogen isotopes in a one-component medium (pure deuterium or tritium) are derived and discussed. The obtained formulae are applied to cycles actually detected in the experiment (detection efficiency epsilon < 1). Formulae enable one to obtain the values of rates of μ-molecule formation and fusion rate in the μ-molecule from direct fits of the data in a finite time-interval for any number of detected cycles.

45594 **(JINR—R-1-83-853) Determination of parameters of the muon catalysis process from thee analysis of experimental time distribution of successively detected events of fusion reactions.** Zinov, V.G.; Somov, L.N.; Fil'chenkov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701830.

Submitted to the journal Nucl. Instrum. Methods.

The expressions for the distributions of the successively detected events t+t and d+t have been obtained. Possibilities to determine the mu-catalysis process parameters without using the detection efficiency of the reactions are discussed.

45595 **(JINR—R-4-84-18) Calculation of total cross sections of the hadron- nucleus interaction at low energies.** Belyaev, V.B.; Mansurov, M.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701831.

Submitted to the journal Sov. J. Nucl. Phys. .

Total cross section is calculated of the pion-deuteron interaction in the framework of the moments methods without using the final-state wave functions. The energy dependence of the cross section is found. The convergence of the method is studied.

45596 **(JINR—R-4-84-45) Successively detected events of the multiple muon catalysis process.** Zinov, V.G.; Somov, L.N.; Fil'chenkov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701834.

Submitted to the journal Sov. J. At. Energy.

The kinetics of multiple muon catalysis process is considered. Expressions for the yields and time distributions of successive events of mu-catalysis reactions detected with epsilon < 1 efficiency have been obtained. The general methods of delivering these expressions are considered and concrete results for the t+t reaction in tritium and d+t reaction in d_2+t_2 mixtere are given. These results can be also applied to the synthesis reactions p+d -> ^{3}He+γ in h_2 d_2 mixture and p+t -> ^{4}He+γ in h_2+t_2 mixture. It is shown that the mu-catalysis process parameters and the detection efficiency can be independently determined for the experimental data analysis.

6513 Nuclear Properties And Reactions, A=6-19, Theoretical

REFER ALSO TO CITATION(S) 45615, 45682

45597 (GANIL-P—84-01) Role of collision terms for nucleon emission in intermediate energy heavy ion reactions. Gregoire, C.; Scheuter, F.; Remaud, B.; Sebille, F. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). Jan 1984. 32p. (CONF-840156—8). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751182.

From 22. international meeting on nuclear physics; Bormio, Italy (23 Jan 1984).

A semi-classical description of heavy ion collisions is developed with a particular attention to the nucleon flux from one partner through the other one. The phase-space extension of the nucleons is explicitly treated by means of the Wigner transform of the density matrix. Its dynamical evolution is obtained by solving the Landau-Vlasov equation, where collision terms are explicitely introduced. As a matter of fact, the experimental nucleon spectra usually described by a thermal source with an intermediate velocity (around vsub(beam)/2) are interpreted in our framework by the coexistence of one-and two-body dissipation. Multi-differential cross-sections $d^3\sigma/dE d\Omega$ are computed for the $^{12}C(86MeV/u) + ^{12}C$ system and are compared with the experimental data. Comparisons are also given for the ^{16}O (20 MeV/u) + ^{197}Au system.

45598 (GSI—85-9) Cooperative production of neutral pions and high-energy photons in nucleus-nucleus collisions at 60-84 MeV/u. Noll, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.)). Mar 1985. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752135.

The described experiments which were performed at the CERN synchrocyclotron with different target-projectile combinations at different beam energies allow a systematic study of the pion production in nucleus-nucleus collisions below the threshold. Thereby the pion production shows clearly the existence of collective effects in the nucleus-nucleus collision in the energy range of 60-84 MeV/u: 1.) The measured cross sections exceed those predicted in the simple nucleon-nucleon collision with Fermi motion by more than one order of magnitude. 2.) The mean velocity determined from the longitudinal rapidity cannot be explained by single nucleon collisions. 3.) The model of the collective pionic bremsstrahlung describes well both the excitation function, the energy spectra, and the angular distribution. Thereby result slow stopping ranges which indicates that the pions in the collision are produced only during a short time. For the asymmetric systems in the rapidity distribution for low pion energies a structure in the data is seen which can be interpreted as two source velocity components which can be caused by superposition of two processes. For photons with energies above 50 MeV in the nucleus-nucleus collision a cross section was found which is comparable with that of pions with the same whole energy. The high-energy photons can be described by electromagnetic bremsstrahlung in the slowing down of the charge in the nuclear field.

45599 (IAE—3756/2) Nonequilibrium processes in neutron emission from helium, lithium-6 and carbon ion reactions. Analysis of experimental data. Bochkarev, O.V.; Korsheninnikov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. 43p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701817.

The inclusive spectra of neutrons from reactions initiated by helium-, lithium- and carbon ions at energies above the Coulomb barrier from 1.6 up to 16 MeV/nucl. are analyzed. The neutrons are produced in the reaction with carbon at 1.6 MeV/nucl. energy as a result of evaporation from a compound nucleus. In all the other reactions the spectra deviation from the equilibrium behaviour is observed. Differential cross sections of neutron production were analyzed twice with the use of representation on the existence of angular-distributed energetic neutron sources. The obtained widths of non-equilibrium neutron, energy distributions cannot be explained by the simplest theories of projectile fragmentation and breakup reactions. These widths are explained in the framework of the exiton- and hybrid models of preequilibrium decay; the models correctly reproduce the form of experimental neutron distributions integrated over the angles, but do not coincide with them in the cross section absolute values. The relaxation times (1-4) x 10^{-22} determined with the use of the hot spot model are in good agreement with the data obtained from the exiton model calculation. The period of the most intensive non-equilibrium emission turned out to be (1.5-3.5) x 10^{-23} s in the hot spot representation and 4 x 10^{-22} s in the exiton representation. Comparison of the preequilibrium neutrons yield cross sections shows a possibility of the existence of the unified mechanism of preequilibrium decay in collisions with both heavy ions and light particles.

45600 (IAEA-SMR—93, pp 63-65) Deuteron exchange mechanism for $^6Li(n,\alpha)$. Weigmann, H. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

In this lecture the analysis of the low energy $^6Li(n,\alpha)$ cross section in a model which combines resonance amplitudes with a direct deuteron exchange mechanism, is presented. Advantages and shortcomings of the present analysis are discussed, and directions of a future improvement of the model are indicated.

45601 (INIS-mf—9306, pp I25) Isotopic and isotonic effect for nucleon production in deep inelastic nuclear reactions. Bayukov, Yu.D.; Degtyarenko, P.V.; Fedorov, V.B.; Gavrilov, V.B.; Goryainov, N.A.; Grishuk, Yu.G.; Gushchin, O.B.; Kornienko, N.L.; Kossov, M.V.; Leksin, G.A. (Institut Teoreticheskoj i Ehksperimental'noj Fiziki, Moscow, USSR). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

45602 (IPNO-DRE—84-20) Comparative study of ($^3He,\pi^-$) and ($^3He,\pi^+$) exclusive reactions on ^7Li and ^{12}C. Bimbot, L.; Hennino, T.; Jourdain, J.C.; Le Bornec, Y.; Reide, F.; Willis, N.; Germond, J.F. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752037.

Differential cross sections of ($^3He,\pi^{+-}$) exclusive reactions have been measured for ^7Li and ^{12}C targets at 235 MeV and 20° laboratory scattering angle. Several levels of the final nuclei have been observed for π^+ as well as π^- production. Simple assumptions for the reactions mechanism are considered for explaining the ratio of π^- to π^+ production.

45603 (ISN—84-24) Search for a possible systematic trend of optical model parameters from 800 MeV polarized protons elastic scattering on light nuclei. de Swiniarski, R.; Pham, D.L. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1984. 5p. (CONF-8406243—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751212.

From Europhysics conference on nuclear reactions; Crete, Greece (24 Jun 1984).

The aim of this paper is to present the first attempt to investigate some possible systematic trend of optical model parameters by analyzing, through the standard optical model, some of the available data for elastic scattering of polarized protons on light nuclei ranging from ^{16}O to ^{26}Mg.

45604 (JAERI-M—84-010, pp 393-399) Measurement of double differential neutron emission cross sections at OKTAVIAN Facility of Osaka University. Yamamoto, Junji; Takahashi, Akito (Osaka Univ., Suita (Japan). Faculty of Engineering). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Some of the recent experimental results of double differential neutron emission cross section (DDX) are shown, that have been measured using the intense 14 MeV neutron source OKTAVIAN of Osaka University. The new data for Li, O, F, Si, Be and Pb are compared with multi-group DDX produced from ENDF/B-IV library.

45605 **(JINR—1-84-491) About the size of a source forming light fragments emitted in relativistic nuclear interactions.** Avdejchikov, V.V.; Lozhkin, O.V.; Murin, Yu.A.; Oplavin, V.S.; Gorshkova, N.L.; Zhidkov, N.K.; Mrowczynski, S.; Nikitin, V.A.; Nomokonov, P.V.; Zlomanczuk, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701840.

Double differential cross sections of hydrogen and helium isotopes production in the target-nucleus fragmentation region are measured at 45 deg, 90 deg and 185 deg emission angles in ^{4}He+Be, C, Al, Cu, Ag, Au reactions at 3.33 GeV/nucleon beam kinetic energy. The size of fragment formation source is determined depending upon atomic number of a target-nucleus and secondary particle registration angle. It is shown that a root-mean-square radius of the source does not depend on energy and sort of an initial particle.

45606 **(JINR—E-1-84-492) Analysis of correlation effects in multinucleon CC interactions at 4.2 GeV/c per nucleon in terms of collective variables.** Agakishiev, H.N.; Didenko, L.A.; Gasparian, A.P.; Grishin, V.G.; Kuznetsov, A.A.; Metreveli, Z.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701844.

An analysis of correlation effects in multinucleon CC interactions at 4.2 GeV/c per nucleon is being carried out in terms of collective variables. It is shown that the correlated emission of proton pairs with large transverse momenta is observed in CC interactions. In the effective mass spectrum of correlated protons there are maxima in the mass range Msub(eff.)=2.15; 2.23; 2.32; and 2.50 GeV which can be an evidence for the existence of dibaryon resonances.

45607 **(JINR—E-4-84-456) Investigation of the reaction ^{16}O(p,n)^{16}F at Esub(p)=135 MeV.** Gareev, F.A.; Ershov, S.N.; Gmitro, M.; Cejpek, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701826.

Submitted to the journal Sov. J. Nucl. Phys. .

The ^{16}O(p,n)^{16}F reaction at 135 MeV has been analyzed the framework of the distorted-wave impulse-approximation (DWIA). Both direct and exchange mechanisms of nucleon knock-out are taken into account. Including the n-particle n-hole (n=0, 1, 2) correlations in the wave functions of A=16 nuclei improves the description of experimental data: diminishes the absolute value of the cross sections about twice as compared with the calculations using the simple particle-hole structure models.

45608 **(JINR—R-4-84-443) Analysis of form factors of electric transitions in light nuclei with the use of electromagnetic current continuity equation.** Gmitro, M.; Kaipov, T.D.; Rzhizek, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701833.

The use of continuity equation for the electromagnetic current leads to the modification of impulse approximation for the formfactors of electric-type transitions. But such procedure is not unique. Two methods are compared of the continuity condition application: by means of the Eisenberg-Greiner decomposition and by means of Rose's decomposition. Reference material for choosing a more suitable method of electric transition analysis is presented in tables and graphs for one-particle matrix elements for E2-transitions of 1p-shell nuclei and for E1-transitions of nuclei in the vicinity of At16 and A=40. Numerical calculations of electromagnetic form factors are made for the transitions to 2.18 MeV (3^+, T=0) level in ^{6}Li and 7.55 MeV ($5/2^-$, T=1/2) level in ^{13}C nucleus. In the examples considered two decompositions lead to similar results. Since the use of continuity equation effectively includes the contribution of the meson-exchange current, such way of analysis should be preferred.

45609 **(SI—83-22) Search for anomalons in projectile fragments of ^{40}Ar using plastic nuclear track detectors.** Heinrich, W.; Drechsel, H.; Trakowski, W.; Beer, J.; Brechtmann, C.; Dreute, J.; Sonntag, S. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). 1983. 10p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

Enlarged cross-sections for projectile fragments of relativistic nuclei have been observed within the first few centimeters after their emission in Bevalac and cosmic ray experiments with nuclear emulsion. We performed an experiment using plastic nuclear track detectors to investigate this phenomenon. A new automatic measuring technique for heavy ion tracks in these detectors enables us to analyze large numbers of fragmentation reactions. The tracks of 14185 fragments with charges $9 <= Z <= 15$ produced in collisions of relativistic ^{40}Ar beam particles were scanned for interactions. Based on 6444 charge changing nuclear collisions we conclude that under our experimental conditions no statistically significant anomalous mean free path effect can be observed.

45610 **Measurement of ^{14}N(γ,π^+)^{14}C (g.s.) at 200 MeV: A test of the distorted-wave impulse approximation for charged-pion photoproduction below the Δ(1232) resonance.** Cottman, B.H.; Min, K.; Stoler, P.; Teng, P.K.; Winhold, E.J.; Yamazaki, M.; Yergin, a.P.F.; Bernstein, A.M.; Blomqvist, K.I.; Distelbrink, J.H.J. (Department of Physics, Rensselaer Polytechnic Institute, Troy, New York 12181). *Physical Review Letters;* **55**: No. 7, 684-687(12 Aug 1985). Contract AC02-76ER03069.

Differential cross sections for ^{14}N(γ,π^+)^{14}C(g.s.) 0^+ 1) have been measured for an incident photon energy E/sub γ/ = 200 MeV at laboratory angles of 45°, 60°, 75°, 90°, 120°, and 140°. Momentum-space distorted-wave-impulse-approximation calculations, using a complete treatment of a one-body pion-photoproduction operator, are found to be in excellent agreement with the experimental data. The effect of the momentum-dependent terms in the nuclear photoproduction operator is observed. The reaction is found to be sensitive to input nuclear structure elements not observable in the (e,e') form-factor data.

6514 Nuclear Properties And Reactions, A=20-38, Theoretical

45611 **(ITP—84-53-E) Study of form factors of elastic and inelastic electron scattering by ^{20}Ne.** Steshenko, A.I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701822.

The elastic electron scattering form factor and also the form factor of inelastic scattering accompanied by nuclear transition into excited states of the ground rotational band are calculated within the Sp(2, R) model reproducing the dynamics of quadrupole nonsphericity of ^{20}Ne. The Sp(2, R) model is shown to describe correctly the experimental dependence of elastic and inelastic (for the $0^+ \rightarrow$ into 2^+ state transition) form factor on the momentum transferred and, consequently, to remove some difficulties experienced by other dynamic models.

45612 (JAERI-M—84-010, pp 365-378) **Total neutron cross sections of magnesium, aluminum, silicon, zirconium, niobium and molybdenum in the thermal range.** Matsumoto, Tetsuo; Aizawa, Otohiko (Musashi Inst. of Tech., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.); Kadotani, Hiroyuki. Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Total neutron cross sections of Mg, Al, Si, Zr, Nb and Mo at room temperature have been measured in the thermal range using a chopper and TOF facility of the Musashi Institute of Technology Research Reactor.

45613 (JAERI-M—84-010, pp 379-387) **Study on neutron capture gamma-rays in the resolved and unresolved resonance regions.** Kitazawa, Hideo; Igashira, Masayuki; Komano, Haruki; Shimizu, Michio; Terazu, Kuninobu; Fukui, Hidehiro (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

We have measured gamma-rays from s- and p-wave resonance neutron capture reactions on ^{28}Si and ^{56}Fe. Anomalous, strong gamma-ray transitions to the ground and first excited states of ^{57}Fe have been observed for neutron capture by ^{56}Fe. In the unresolved resonance region neutron capture gamma-ray spectra with the pigmy resonance have been obtained for ^{141}Pr, ^{159}Tb, ^{165}Ho, ^{181}Ta and ^{197}Au.

45614 **(JINR—R-1-84-532) Free path length of neon-22 fragments in photoemulsion at 4.1 A GeV/c momentum and anomalon problem.** Bannik, B.P.; Batusov, Yu.A.; Bokova, L.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701845.

6053 interactions of fragments with 3 up to 10 charges have been registered in nuclear photoemulsion irradiated with neon-22 nuclei at 4.1 GeV/c momentum per nucleon. Statistical analysis of mean free paths of these fragments before their interaction with nuclei in photoemulsion has been carried out. No dependence of mean free paths before the interaction upon the distance covered with the fragments has been discovered. No indication to the existence of anomalons has been obtained.

45615 **High-spin states in ^{24}Mg.** LeVine, M.J.; Barrette, J.; Kubono, S. (Brookhaven National Lab., Upton, NY (USA)); Branford, D. (Edinburgh Univ. (UK). Dept. of Physics). *Journal of Physics G: Nuclear Physics;* **10**: No. 11, 1549-1558(Nov 1984).

The ^{12}C(^{16}O,α)^{24}Mg reaction has been used to study states in ^{24}Mg at excitation energies up to 27 MeV. Total widths have been measured for 34 states. Alpha-branching ratios, and α-α angular correlations have been measured for 12 states above 19.5 MeV. Candidates for 10^+ and 12^+ states in ^{24}Mg are deduced from a comparison with shell-model predictions.

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

45616 **(AERE-R—11464) Complete and incomplete fusion and pre-equilibrium emission in heavy ion reactions sharing the compound nucleus ^{63}Cu.** Parker, D.J. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.; Oxford Univ. (UK). The Queen's Coll.). Sep 1984. 258p. HMSO, London, price Pound 12.00.

The contributions of complete fusion and particular incomplete fusion processes, and the importance of pre-equilibrium emission have been investigated for medium energy light heavy ion nuclear reactions on medium mass targets. The system chosen for study was the compound nucleus ^{63}Cu, and the thesis describes studies of the three entrance channels: α + ^{59}Co, ^{7}Li + ^{56}Fe and ^{12}C + ^{51}V.

45617 **(FRNC-TH—1183) Contribution to very inelastic collisions. Emission mechanism of light charged particles and angular momentum transfer in ^{40}Ar (280 MeV) + ^{58}Ni nuclear reactions.** Babinet, R. (Paris-11 Univ., 91 - Orsay (France)). Jul 1981. 270p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85751204.

This work ends a particularly detailed study on very inelastic collisions in ^{40}A (280 MeV) + ^{58}Ni reaction. The two experiments in coincidence (fragment-fragment and particle-fragment) which are this work basis, essentially experimental, are the following of the very precise inclusive measurements already done on this system. They allowed to precise many important aspects of the reaction mechanism. Conclusions from a precise analysis of the fragment kinematics near the mass symmetry is the new aspect of this study. Information implicitely contained in the two complementary fragment angular correlation width are particularly detailed. Concerning the particle-fragment coincidence experiment, a quantitative analysis method of the invariant cross sections (in the reaction plane) has been developed; it shows clearly what is the origin of the emitted particles. The result of a two-stage mechanism allows to interpret simply the anisotropy out-of-plane of the alpha particle emission. The individual spin has been obtained for the first time for each of the two fragments of very inelastic collisions in nearly all the mass asymmetry domain.

45618 **(IAE—3755/2) Study on the energy spectra of neutrons from the helium, lithium-6 and carbon ion reactions at energy of 4-20 MeV per nucleon with production of zinc-65 compound system. Experimental data.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Chulkov, L.V.; Yan'kov, G.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. 39p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701846.

The 1.5-meter isochronous cyclotron of the Kurchatov Nuclear Energy Institute with the time-of-flight spectrometer is used to measure energy spectra and angular distributions of neutrons appearing in reactions ^{62}Ni+ ^{3}He, ^{4}Ni+α, ^{59}Co+^{6}Li and ^{53}Cr+^{12}C. At the energy of incident particles 10-15 MeV/nucl. experimental results prove the presence of a considerable share of high energy neutrons in the general spectrum emitted by nuclei preliminarily in the forward direction.

45619 **(JINR—R-4-84-32) Transversal E1-resonance in spherical nuclei.** Vdovin, A.I.; Nguen Din' Dang; Ponomarev, V.Yu.; Shilov, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701815.

Submitted to the journal Phys. Scr.

The spin-flip1^--states in medium and heavy spherical nuclei are investigated within the quasiparticle-phonon model. The random phase approximation calculations predict the existence of a collective 1^--state formed by the isovector spin-dipole force. Its excitation energy is about 20 MeV. this state is intensively excited by the inelastic electron scattering at momentum transferred q approximately 0.5-0.7 fm^{-1}, at the scattering angles theta > 60 deg. The main contribution to its excitation comes from the transversal formfactor. Therefore, it can be recognized as the transversal formfactor. Therefore, it can be recognized as the transversal E1-resonance. The interaction with two-phonon states causes a very strong fragmentation of the resonance, thus making its experimental observation hardly probable. The consideration is carried out for the ^{58} Ni nucleus.

45620 **Relativistic impulse approximation for meson-nucleus scattering in the Kemmer-Duffin-Petiau formalism.** Clark, B.C.; Hama, S.; Kaelbermann, G.R.; Mercer, R.L.; Ray, L. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). *Physical Review Letters;* **55**: No. 6, 592-595(5 Aug 1985).

The first application of the Kemmer-Duffin-Petiau wave equation for spin-0 particles to meson-nucleus scattering is given. A relativistic impulse approximation using the Kemmer-Duffin-Petiau formalism is used to calculate meson-nucleus optical potentials. Comparison with the nonrelativistic impulse approximation is given.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

REFER ALSO TO CITATION(S) 45646

45621 (GSI—85-11-Prepr.) Decay studies of neutron-rich isotopes of manganese, iron, cobalt, nickel, copper and zinc. Runte, E.; Gippert, K.L.; Schmidt-Ott, W.D.; Tidemand-Petersson, P.; Ziegeler, L.; Kirchner, R.; Klepper, O.; Larsson, P.O.; Roeckl, E.; Schardt, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751896.

A 46 mg/cm^2 thick sup(nat)W target was irradiated with an 11.5 MeV/u ^{82}Se beam. On-line mass-separated samples of projectile-like neutron-rich products from multi-nucleon transfer reactions were investigated by β-γ spectroscopy in the mass region A = 52-79. Decay properties of the nuclei ^{61}Mn (0.71 s), ^{64}Fe (2.0 s), ^{65}Co (1.25 s), ^{69}Ni (10 s) and sup(73m)Zn (5.8 s) were measured for the first time. For ^{67}Ni a decay scheme could be constructed using information from new γ-transitions. The known decay schemes of ^{60}Mn, ^{63}Fe, ^{63}Co and ^{69}Cu were extended. New half-life values of neutron-rich isotopes are compared with theoretical predictions.

45622 (IFVE-ORI-OEF—84-36) Multiple Coulomb scattering of 7.3 and 11.7 GeV/c muons on Cu target. Akimenko, S.A.; Belousov, V.I.; Blik, A.M.; Britvich, G.I.; Kolosov, V.N.; Kut'in, V.M.; Lebedev, V.N.; Peleshko, V.N.; Rastsvetalov, Ya.N.; Solov'ev, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 11p. (In Russian). (SERP-E—102). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701847.

Submitted to the journal Nucl. Instrum. Methods.

Angular distributions of muons, scattered on the Cu target of 1 radiation length thick are measured up to approximately 10 THETA$_0$ (THETAsub(0)=chisub(c)Bsup(1/2) are standard parameters of the Molie're theory). The results are compared with the Molie're theory; theoretical scattering probabilities are found to exceed the experimental data by a factor of 2-5 at scattering angles greater than 5THETA$_0$. The same comparison with the modified Molie're theory that includes a nuclear form factor is shown to remove the above-mentioned discrepancies within the achieved statistical errors.

45623 (INIS-mf—9698) Competition between collective and single particle excitations in nuclear structure description. Petrovici, A.N. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1983. 25p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701935.

Summary of a doctorate thesis.

The microscopic description of the quadrupole collective dynamics in even krypton isotopes is presented. A microscopic calculation of Bohr's collective Hamiltonian is used to describe the collective motion in ^{76}Kr. A single-particle basis calculated in a deformed Woods-Saxon potential leads to the potential energy surface obtained by the Strutinsky renormalization procedure, and to the inertial functions determined in the cranking model approximation. The collective Schroedinger equation is solved numerically to analyse the low-energy, even parity states in ^{76}Kr. A good agreement between experiment and theory is obtained without specifically adjusting any parameter in the model for this nucleus. Some results regarding statical and dynamical characteristics of sup(74,78,80)Kr isotopes are also presented. The asymmetric rotor model with admixture of two quasiparticles is used to describe the sup(66,68,70)Ge and the sup(64,66)Zn isotopes. The interplay of collective and single particle motions is further investigated by magnetic moment measurements using the method of integral angular correlations perturbed by recoil into gas. The results involve g-factor measurements for ^{166}Ho, ^{68}Ge, ^{64}Zn, ^{66}Zn and ^{68}Ga nuclei. Finally, a discussion of further possible improvements and more general developments of the problems under investigation is given.

45624 (INIS-mf—9699) Intermediate processes in nuclear reactions. Petrovici, M. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1983. 25p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701937.

Summary of a doctorate thesis.

The main results presented here cannot be interpreted in terms of the direct reaction model or the statistical models and one can more or less explicitely use some nuclear configurations for their interpretation. The first chapter deals with the so-called second order intermediate structures observed in the elastic and inelastic proton scattering on ^{66}Zn and ^{70}Ge targets in the energetic regions of some isobaric analog resonances. A formal theory for their interpretation is developed and the comparison with the experimental data is presented. New experimental results on the resonant structures observed in the elastic and inelastic scattering of ^{12}C on ^{24}Mg are presented in the second chapter. Detailed statistical analysis and their interpretation is also presented. Charge equilibration in deep inelastic collisions is the main subject of the third chapter. The experimental results obtained by the ^{98}Mo + ^{154}Sm collision at 12 MeV/n, a quantum treatment of a damped harmonic oscillator and the comparison with the experimental data are given. In the last chapter, some results on the existence of two other processes which could be involved in the main topic are presented. Those processes are: the fast fragmentation and preequilibrium charged particles emission. All these processes originate in the excitation of some simple configurations which can be seen on "doorway" states ("Hallway" in the case of the second intermediate structures). The coupling of these states to other more complicated excitation modes of the nuclei and to outgoing channel gives the possibility to study the nuclear dynamics. This justifies the interest for their detailed theoretical and experimental investigations.

45625 (INIS-mf—9701) Contributions to the study of nuclear reactions mechanism induced by heavy ions on intermediate mass nuclei. Avrigeanu, M. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1982. 22p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701819.

Summary of a doctorate thesis.

A detailed analysis is presented, based on Hauser-Feshbach statistical model calculations of the γ-ray excitation functions measured in the sup(74,76)Ge (^{12}C, xn) and sup(72,73)Ge (^{16}O,xnyp) reactions. The most usual quantities provided by the in beam γ-ray measurements such as the cross sections for the population of the final states as well as the decay scheme and the degree of alignment of these states mainly offer the means of testing models of both the reaction mechanism and nuclear properties of high excitation energies, since they concentrate information on the whole reaction process. Experimental information on sup(85,86)Sr and sup(85,86)Y, γ-decay scheme and the excitation functions for the population of the final states were obtained by sub(74,76)Ge (^{12}C,αn), n = 2-4, sup(74,76)Ge (^{14}N,xn) n = 3-5, sup(72,73)Ge (^{16}O,xnyp), x = 1-3, y=1 reactions at incident energies between 35 and 60 MW. Statistical model calculations in the Hauser-Feshbach formalism have been compared with the experimental γ-ray excitation functions. The competitive emission of neutrons, protons, alpha particles and gamma rays from the compound nucleus has been considered in the calculations. The calculations describe satisfactorily the total cross sections for the population of the 2n, 3n and 4n channels for ^{12}C + sup(74,76)Ge and 2n, np, 3n and 2np channels for ^{16}O + ^{73}Ge. The calculations are sensitive to the characteristics of the excited levels (such as spin values) but htis this sensitivity could be exploited with some reliability only if one makes use of a rather complete level scheme in the calculations. In the case of 2n, np, 3n and 2 np channels for ^{16}O+^{73}Ge one concludes on the reliability of consideration some structural aspects in the calculations.

45626 (JAERI-M—84-010, pp 318-328) **Measurements of neutron cross sections at JAERI linac.** Nakajima, Yutaka (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Following three experiments recently performed at JAERI linac are presented: (1) Measurements of the neutron resonance parameters of ^{81}Br and ^{181}Ta, (2) measurements of neutron capture cross sections of ^{15}Gd and ^{157}Gd in the keV region, and (3) measurements of neutron total cross sections of ^{238}U by the iron-filtered beam.

45627 (PNL-SA—13278) **Recent progress in laboratory $\beta\beta$-decay experiments and their interpretation.** Avignone, F.T. III; Brodzinski, R.L.; Evans, J.C. Jr.; Hensley, W.K.; Miley, H.S.; Reeves, J.H. (Pacific Northwest Labs., Richland, WA (USA); South Carolina Univ., Columbia (USA)). Jun 1985. Contract AC06-76RL01830. 19p. (CONF-8506178—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016618.

From Cretan international meeting on subatomic physics; Crete, Greece (23 Jun 1985).

We give a brief review of the current status of some efforts to directly observe 2nu and 0nu, $\beta\beta$-decay in the laboratory and of the results of recent nuclear structure calculations needed for their interpretation. 32 refs., 5 figs., 6 tabs.

6517 Nuclear Properties And Reactions, A=90-149, Theoretical

45628 (CONF-850507—49) **Accurate determination of the parameters of the 292.4-eV resonance of ^{91}Zr and the 301.1-eV resonance of ^{96}Zr.** Salah, M.M.; Harvey, J.A.; Hill, N.W.; Hussein, A.Z.; Perey, F.G. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016398.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High-resolution transmission measurements of zirconium metal samples have been carried out at ORELA using the 80-m flight path and an improved ^{6}Li-glass scintillation neutron detector. Four different thicknesses of the pure zirconium metal and one sample of zircaloy were used in four separate experiments. The transmission data for these samples were measured at room temperature, and one sample was cooled to liquid nitrogen temperature. These data were analyzed using the multilevel R-matrix computer code SAMMY. The resonance parameters obtained for the 292.4-eV resonance of ^{91}Zr (including both statistical and systematic uncertainties) are: J/sup π/=3^{+}, E$_0$=292.40 +- 0.10 eV, Γ/sub n/=665 +- 5 MeV, Γ/sub γ/=131 +- 10 MeV, and cc(Γ/sub n/, Γ/sub γ/)=0.14. The parameters obtained for the 301.1-eV resonance in ^{96}Zr are: J=1/2, E$_0$=301.14 +- 0.10 eV, Γ/sub n/=223 +- 7 meV, Γ/sub γ/=285 +- 38 MeV, and cc(Γ/sub n/, Γ/sub γ/)=0.80.

45629 (GSI—85-2) **Cold fusion in symmetric ^{90}Zr induced reactions.** Keller, J.G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 5 - Physik). Feb 1985. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85751888.

At the velocity filter SHIP of the Society for Heavy Ion Research in Darmstadt cross sections for evaporation-residue-nucleus formation in the reactions ^{90}Zr + ^{89}Y, sup(90,92,96)Zr, ^{94}Mo were measured. In four of the reactions leading to the compound nuclei ^{179}Au, ^{180}Hg, ^{182}Hg, and ^{184}Pb for the first time in reactions of two heavy partners with mass numbers >20 radiative capture, i.e. deexcitation only by emission of γ radiation, was observed. A comparison of the measured cross sections for radiative capture with evaporation calculations leads to the final conclusion that either the γ-strength in the different compound nuclei is very different, or that the energy or angular momentum dependence of the level-density is wrongly described by the Fermi gas model at energies between 5 and 20 MeV. From the cross sections for evaporation-residue-nucleus formation fusion probabilities for central collisions were derived. The fusion probabilities show a strong dependence of the sub-barrier fusion from the nuclear structure of the contributing reaction partners. The slope of the fusion probability below the classical fusion barrier cannot be consistently described even by newer models. Below the lowest fusion barrier the fusion probability decreases with decreasing energy remarkably faster that predicted by a WKB calculation. This indicates that either the shape of the barrier is different from that predicted by the potentials, or that the mass dependence of the tunnel effect is not correctly described by the WKB calculation.

45630 (GSI—85-8) **Nuclear moments and changes of the mean square nuclear charge radii in tin and indium.** Lochmann, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.). Fachbereich Physik). Mar 1985. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752100.

By collinear laser spectroscopy on stable tin isotopes an on radioactive neutron-deficient tin isotopes produced by heavy ion fusion as evaporation residual nuclei by measurement of hyperfine structure splittings and isotope shifts the nuclear moments and the change of the mean square nuclear charge radii were determined. The present thesis is a continuation of the first measurements on evaporation residual nuclei of the indium isotope chain (Z=49) and presents results for the isotopes sup(105,106)In as well as the results on the isotope chain of tin (Z=50), with the radioactive isotopes sup(108,109,110)Sn and the chain of the stable isotopes $^{112-124}$Sn. The radioactive tin and indium isotopes were produced in the reaction channels ^{98}Mo (^{16}O, 3n-6n) $^{111-108}$Sn and ^{94}Mo (^{16}O, p3n, p4n) sup(106,105)In. In tin the transition with lambda=452.5 nm (5p^2 ^{1}S$_0$ -> 5p6s ^{1}P$_1$) was excited and fluorescence at lambda=326.3 nm (5p6s ^{1}P$_1$ -> 5p^2^{1}D$_2$) detected. In indium the optical excitation ensued with lambda=451.1 nm (5p ^{2}Psub(3/2) -> 6s ^{2}Ssub(1/2)) and the fluorescence detection with lambda=410.2 nm (6s ^{2}Ssub(1/2) -> 5p ^{2}Psub(1/2)). The magnetic dipole moments derived from the hyperfine structure splittings of the indium spectra show for all isotopes of the whole chain $^{105-115}$In at each nuclear spin a relatively constant slope. From the slope of the measured spectroscopic quadrupole moments a constant static deformation of $<\beta>$ = 0.12 results.

45631 (GSI—85-12-Prepr.) **Decay properties of the new proton-rich nucleus ^{104}Sn: Mass determinations beyond the proton drip line.** Rathke, G.E.; Rykaczewski, K.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Roeckl, E.; Schardt, D.; Grant, I.S.; Larsson, P.O.; Plochocki, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751897.

Submitted to Z. Phys., A.

The new proton-rich nucleus ^{104}Sn was produced in a ^{50}Cr(^{58}Ni, 2p2n)^{104}Sn reaction. Its half-life was measured to be 21 +- 1 s. From a newly established partial decay scheme, a Qsub(EC) value of 4000 (+650-300) keV was estimated. The resulting mass excess value for ^{104}Sn, combined with decay energies for α and proton emission, leads to mass excess values for the nuclei ^{108}Te, ^{109}I, ^{112}Xe, and ^{113}Cs. These mass values are compared to predictions of mass formulae.

45632 (INIS-mf—9695) **Study of the cumulative effect in meson and nucleonic system production.** Pentia, M. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1984. 25p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701818.

Summary of a doctorate thesis.

Relativistic nuclear reactions with protons (deuterons) 8.0 GeV/c in the limiting fragmentation region (4-momentum transfer Q >= 1 GeV), with the particle production energy exceeding the nucleon-nucleon kinematical limit, were studied. The data acquisition, processing and analysis methods are presented along with experimental results like energy, angular distributions and A-mass de-

pendence, carried out on DISC-2 Spectrometer (Dubna). Scale invariance character of the meson production, tells about local, point-like interactions, interpreted like violent quark collisions. The quark structure functions of nuclei was obtained, proving the existence of multiquark states in nuclei.

45633 **(IPNO-DRE—84-33) Energy dissipation in nucleus-nucleus collisions around 40 MeV per nucleon. New phenomena or transition trends.** Lefort, M.; Borderie, B.; Jacquet, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 37p. (CONF-8409225—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752038.

From Colloquium on heavy ion collisions; Cargese, France (2 Sep 1984).

We have tried to present some of the new aspects which appeared recently in nucleus-nucleus reactions at collision velocities in the range of 0.2 c to 0.3 c. From a set of experimental data obtained at CERN and GANIL by the Orsay Nuclear Chemistry Group, we have tentatively extracted some preliminary conclusions about the possibility of very large energy deposits occuring in more or less central collisions. We have shown that, when nuclear matter is heated at excitation energies greater than 3 to 4 MeV per nucleon, quite a number of new aspects appear in the de-excitation process. Also, for intermediate impact parameters, a new phenomena, predicted by Bondorf and by Campi et al., might have been observed: "multifragmentation". We should emphazise that what is presented here results from a collective work and is an attempt to show how physicists try to progress from the raw materials of their experiments towards some more elaborated considerations.

45634 (JAERI-M—84-010, pp 148-164) **Nuclear reaction models newly adopted in JENDL-3 evaluation.** Kikuchi, Yasuyuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

The spherical optical model and the statistical model based on the compound nucleus assumption have been mainly used in JENDL-2 evaluation. These models cannot consider (1) the direct reactions, (2) the pre-equilibrium processes and (3) the nuclear deformation effect. This drawback is particularly severe for high energy neutrons important for fusion neutronics. In order to overcome this drawback, it was decided to adopt the coupled channel optical model and the evaporation model with pre-equilibrium process in JENDL-3 evaluation. The ECIS and GNASH codes were selected. A special care was paid to combine the coupled channel optical mode to the usual statistical model. The cross sections of natural iron were re-evaluated with these newly adopted models. The results reproduce satisfactorily the experimental data of the angle-energy double-differential cross sections for 14 MeV neutrons, proving the applicability of the present model.

45635 (JAERI-M—84-010, pp 221-230) **Nuclear data in the intermediate energy region. Yield and transport of spallation neutrons.** Nakahara, Yasuaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Summary has been made of nuclear data in the energy region of 20 MeV – 2 GeV, which are required in INS(Intense Neutron Source) developments and analyses of transmutation of the radioactive wastes and breeding of the fissile material. From the viewpoint of nucleon transport calculations, discussions are made on the foundamental concepts of nuclear data and the present status of data on spallation reactions, fission cross sections and neutron yields.

45636 (JAERI-M—84-010, pp 277-285) **Measurements of double differential cross sections (DDX) for several medium-weight and heavy nuclei at 15 MeV.** Iwasaki, Shin (Tohoku Univ., Sendai (Japan)). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Measurements of double differential cross sections (DDX) for several intermediate and heavy nuclei have been performed at 15 MeV in the Dynamitron Laboratory at Tohoku University. Comparison of the experimental data with the evaluated nuclear data file, ENDF/B-IV revealed that the data file could not reproduce the experimental ones, particularly in the angular distributions. Nuclear model calculation showed that the preequilibrium process was important in the present incident energy region. Measurements have been performed for titanium, niobium, molybdenum, lead, and thorium (in progress), including the light elements, carbon and aluminum.

45637 (JAERI-M—84-010, pp 388-392) **Neutron activation cross section of molybdenum isotope at 14.8 MeV.** Katoh, Toshio; Amemiya, Susumu; Ishibashi, Kei-ichi (Nagoya Univ. (Japan). Faculty of Engineering). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

The neutron activation cross section of Molybdenum isotopes have been measured for the 14.8, MeV neutron. The cross sections have been determined with reference to the known $^{27}Al(n,\alpha)\ ^{24}Na$ and the $^{27}Al(n,p)\ ^{27}Mg$ reactions. The cyclic activation method was employed for the γ-ray measurement of short-lived nuclei. Cross section data are presented for (n,2n), (n,p) and (n,α) reactions on Mo isotopes.

45638 **(JINR—6-84-96) Investigation of the ^{133}Ce internal conversion electron spectrum.** Gromov, K.Ya.; Islamov, T.A.; Kononenko, G.A.; Lebedev, N.A.; Morozov, V.A.; Muminov, T.M.; Kholmatov, A.Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 11p. (In Russian). (CONF-8404189—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701854.

From 34. conference on nuclear spectroscopy and nuclear structure; Alma-Ata, USSR (17 Apr 1984).

Submitted to the journal Bull. Acad. Sci. USSR, Phys. Sci. .

The spectrum of internal conversion electron (ice) of ^{133}Ce is studied using the beta-spectrograph with permanent magnetic field. The lines of 16 earlier unknown γ-transitions are detected. The mixing ratios of the γ-transition multipolarities with energies 42.7, 58.4, 76.9, 87.9, 97.3 and 130.8 keV are determined from the ratios of intensities of the ice l_1-, l_2- and l_3-l lines. Conclusions on the multipolarity for 40 γ-transitions are made for the first time.

45639 **(JINR—6-84-220) Internal conversion electrons in the ^{134}Ce decay and ^{134}La levels.** Islamov, T.A.; Lebedev, N.A.; Kholmatov, A.Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701852.

Submitted to the journal Bull. Acad. Sci. USSR, Phys. Sci. .

Internal conversion electron (ICE) spectrum of ^{134}Ce (Tsub(1/2)=75.9 h) has been measured by means of a beta spectrograph with a constant magnetic field. Energies and relative intensities of ICE lines for 27 γ transitions related to ^{134}Ce decay have been determined. From the intensity ratio of L_1-, L_2- and L_3-lines of ICE the multipolarity composition of the following transitions has been determined: 22.7 keV - M1 + 1.5(3)%E2; 31.9 keV - M1 + 2.8(6)%E2; 39.1 keV - M1 + 1.9(5)%E2 and 162.3 keV - M1 + 36(14)%E2. Multipolarities for 26 γ transitions have been determined, 23 of them - for the first time. Experimental results obtained permit to ascribe the quantum characteristics to 1^+ levels of ^{134}La with 54.7; 93.7; 162.3; 252.5; 294.3; 355.5 keV energies; and to 0^+, 2^+ levels with 31.9; 136.3; 187.0 and 205.3 keV energies.

45640 **(JINR—6-84-388) Excited states of the odd-odd ^{132}La nucleus.** Abdurazakov, A.A.; Kholmatov, A.Kh.; Vylov, Ts.; Kalinnikov, V.G.; Mikhajlova, M.M.; Zhelev, Zh.; Islamov, T.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701853.

Submitted to the journal Bull. Acad. Sci. USSR, Phys. Sci. .

Spectra of γ-rays and internal conversion electrons of ^{132} are investigated. 56 γ-transitions are observed, 36 of them are new. For 36 γ-transition multipolarities are determined, for 27 of them - for the first time. The experimental results obtained at the ^{132}Ce vecay permit to describe the quantum characteristics for the 2^+ level of ^{132}La with 155.4 and 216.8 keV energies; and for the 1^+ level with 182.1; 279.1; 359.0; 406.8; 485.0; 523.8; 606.7; 648.3; 731.7; 820.0 keV energies.

45641 (JINR—D-7-83-644, pp 158-172) **Laser spectroscopy of radioactive beams.** Otten, E.W. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik). 1983. NTIS (US Sales Only), PC A25/MF A01. File Number DE85781272. (CONF-830444—).

From International school-seminar on heavy ion physics; Alushta, USSR (14 Apr 1983).

The problem of using the laser spectroscopy in investigations radioactive beams is considered. The main attention is payed to the isotope shift of nuclear charge radii delta $<r^2>$. The general trend of delta$<p^2>$ is discussed. Predictions for delta$>r^2>$ in the framework of the droplet model are given. It is noted that two parameter interpretation of the isotope shift based on the droplet model works the better, the further the distance spans and the clearer the nuclear structure is.

45642 (JINR—D-7-83-644, pp 86-101) **Properties of nuclei far from stability studied recently at the GSI on-line mass separator.** Klepper, O. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A25/MF A01. File Number DE85781272. (CONF-830444—).

From International school-seminar on heavy ion physics; Alushta, USSR (14 Apr 1983).

Three experiments at the GSI mass-separator facility on-line to the heavy-ion accelerator UNILAC are described. The first one is devoted to the problem of production of neutron-rich isotopes in quasi-elastic and deep-inelastic transfer reactions. The second one is related to direct and beta-delayed proton emission of lanthanides, especially the direct proton decay of ^{147}Tm and β-delayed proton emission of ^{147}Er and ^{147}Dy. Finally, the collinear laser spectroscopy of light indium isotopes is described.

45643 **(JINR—E-1-84-411) Characteristics of the particle production process in hadron-nucleus collisions: multiplicities and dispersions.** Sredniawa, B.; Strugalska-Gola, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701838.

Multiplicities, i.e., the numbers of particles produced in hadron-nucleus collisions and dispersions of these mean numbers are calculated assuming the model of Strugalski. Energy- and A-dependence of multiplicities are calculated for 24 nuclei from $_6{}^{12}$C to $_{92}{}^{238}$U for pion-nucleus collisions in the range of 16-147 GeV/c and for proton-nucleus collisions between 19 and 1480 GeV/c. Multiplicities are comprised between 4.9 and 13.6 for pion-nucleus collisions and between 5.2 and 31.5 for proton-nucleus collisions. The dispersions of multiplicities are calculated for 10 elements between $_6{}^{12}$C and $_{92}{}^{238}$U in the same energy ranges and vary from 4.2 to 10.1 for pion-nucleus collisions and from 3.0 to 11.0 for proton-nucleus collisions. The agreement with available experimental data is good.

45644 **(JINR—E-4-84-72) Excitation of states with a different lambdasup(π) in the inelastic electron scattering at backward angles.** Ponomarev, V.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701828.

Submitted to the journal Sov. J. Nucl. Phys.

The cross section of the one-phonon state electroexcitation in ^{90}Zr is calculated in dwba. The electron energy varies from 30 to 140 MeV while a scattering angle is fixed: theta=160 deg. A contribution of the states with different lambdasup(π) (lambdasup(π) = 1^{+-} - 6^{+-}) to the reaction cross section is analysed.

45645 **(JINR—E-4-84-305) Microscopic approach to the description of heavy-ion elastic scattering.** Dao Tien Khoa; Shitikova, K.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701842.

Submitted to the journal Sov. J. Nucl. Phys. .

A microscopic approach is developed for the description of elastic heavy ion scattering to study the nuclear structure effects in heavy ion collisions. Nucleus-nucleus interaction potential is calculated within the folding model. The elastic ^{6}Li, ^{12}C, ^{16}O scattering on sup(58,60)Ni, ^{90}Zr, ^{124}Sn, sup(142,144)Nd, and ^{208}Pb has been investigated. The nuclear densities for light nuclei-projectiles are calculated in the method of hyperspherical functions. The densities for heavy ion targets are calculated within the quasiparticle-phonon model. The results of calculations show that the experimental data can be reproduced in most cases with only the adjustable parameter.

45646 **(JINR—E-4-84-377) Fragmentation of two-quasiparticle states in some spherical nuclei.** Voronov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701825.

Strength distributions of two-quasiparticle states which could be excited in two-nucleon transfer reactions on some spherical nuclei is calculated within the quasiparticle-phonon model. The experimental data for (r.t) and (α, ^{6}He) reactions are analysed. It is shown that bumps observed via these reactions are specified by excited valence-hole and hole-hole states.

45647 **(JINR—R-3-84-42) Right-left asymmetry of γ quanta yield in a neutron resonance of ^{117}Sn with parity nonconservation.** Alfimenkov, V.P.; Borzakov, S.B.; Vo Van Tkhuan; Mareev, Yu.D.; Pikel'ner, L.B.; Frank, I.M.; Khrykin, A.S.; Sharapov, Eh.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701848.

Submitted to the journal JETP Lett. .

The right-left asymmetry was observed for the first time in the yield of γ quanta (esub(γ) = 9.32 MeV) from radiative capture of polarized neutrons in the channel with total neutron momentum jsub(n) = lsub(n) + ssub(n) = 1/2 was obtained d: GITAsub(psup(1/2))sup(n) = (0.27 +- 0.03)GITAsub(p)sup(n).

45648 **(JINR—R-3-84-668) Differential neutron scattering cross sections and average neutron parameters of cadmium isotopes.** Zo In Ok; Poplova, A.I.; Popov, A.B.; Salamatin, I.M.; Samosvat, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701849.

The averaged differential neutron scattering cross sections are measured for the 106, 108, 110, 112 and 116 even-even cadmium isotopes the booster mode on the IBR-30 reactor experimental values the s-and p-wave streng a functions and the parameters of potential scattering are obtained which correspond to two boundary conditions set on the wave functions. The obtained average parameters of cadmium isotopes for these boundary conditions are tabulated. The new results agree well with the data on neighbouring nuclei and confirm the presence of experimentally found spin-orbital splitting in p-neutron strength function.

45649 **(JINR—R-3-84-669) Measurements of total cross sections of molybdenum and cadmium in the 20-1100 keV range on neutron filtered beam.** Zo In Ok; Popov, A.B.; Samosvat, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701850.

Mo and Cd total cross sections were measured in the booster mode on the IBR-30 reactor using the beam of neutrons having passed through an iron or aluminium filter. The application of filters combined with the time-of-flight method permits to separate neutron energy groups in the 20-1100 keV range and to obtain values of a total cross section of the investigated sample. The obtained values of total cross sections for Mo and Cd are presented as tables and graphs where their values are compared with the scattering cross section data.

45650 **(JINR—R-6-84-66) Level scheme of ^{144}Nd from the (n,2γ) reaction.** Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701851.

Submitted to the journal Bull. Acad. Sci. USSR, Phys. Sci. .

The (n, 2γ) reaction on thermal neutrons was studied by the method of summation of amplitudes of coincident pulses from two Ge(Li)-detectors. Intensities of 39 two-quanta cascades populating 5 low-lying states and γ-transition energies in these cascades are determined. Level scheme is constructed which contains 30 levels within the 1310-5725 keV excitation energy range. Results of the measurements are coincided with data obtained by other methods in the excitation energy range up to 3.5 MeV.

45651 **Mass-asymmetric fission of light nuclei.** Sierk, A.J. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **55**: No. 6, 582-583(5 Aug 1985).

Barriers to the mass-asymmetric fission of ^{111}In are calculated in the liquid-drop and in the Yukawa-plus-exponential finite-range models. The calculated barrier heights are compared to those previously inferred from fission excitation functions for 3< or =Z< or =11. The liquid-drop-model barriers are about 12 MeV too high, while the finite-range model gives barriers an average of 1.6 MeV too high. This type of experimental data should make possible a more precise determination of the surface-energy and surface-asymmetry coefficients in semiempirical nuclear mass formulas.

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REFER ALSO TO CITATION(S) 45623, 45624

45652 **(CERN-EP—84-110) Capture ratio N/M in the EC beta decay of ^{163}Ho.** Laegsgaard, E.; Andersen, J.U.; Beyer, G.J.; De Rujula, A; Hansen, P.G.; Jonson, B.; Ravn, H.L. (Aarhus Univ. (Denmark). Inst. of Physics; European Organization for Nuclear Research, Geneva (Switzerland); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 28 Aug 1984. 8p. (CONF-8409143—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901939.

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Considerable interest is attached to the nuclear properties of the isotope ^{163}Ho owing to its possible application in experiments to determine the mass of the electron neutrino. From recent experiments we now know the partial M-capture half-life T/sub 1/2//sup M/, the physical half-life T/sub 1/2/ and have a direct but inaccurate value of 2.3 +- 1.0 keV for Q/sub EC/, the beta decay energy. The M x-ray spectrum of ^{163}Ho has also been measured. We report the determination of the N/M capture ratio and the redetermination of T/sub 1/2//sup M/ by total-absorption spectrometry. 10 refs., 2 figs.

45653 (INIS-mf—9489, pp 207-212) **Pion production in collisions of relativistic ions.** Bialkowska, H. (Institute of Nuclear Research, Warsaw (Poland)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The results of an extensive study of pion production in the collisions of relativistic ions of d, α and ^{12}C with heavy target Ta performed in Dubna at the energy per nucleon of 4,2 GeV/c are shown. Some new data on rapidity distributions of pions and shape of the multiplicity distributions of pions for various classes of collisions are discussed. (I.L.).

45654 (JINR—D-7-83-644, pp 114-127) **Proton radioactivity of ^{151}Lu and neighbouring nuclei.** Hofmann, S.; Armbruster, P.; Hessberger, F.P.; Munzenberg, G.; Reisdorf, W.; Schneider, J.R.H.; Schott, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A25/MF A01. File Number DE85781272. (CONF-830444—).

From International school-seminar on heavy ion physics; Alushta, USSR (14 Apr 1983).

Proton radioactivity of ^{151}Lu and neighbouring nuclei is discussed. Partial proton half-life for transitions ^{151}Lu→^{150}Yb, ^{150}Yb→^{149}Tm and ^{150}Lu→^{149}Yb is calculated. Level schemes of ^{151}Lu, ^{150}Yb and ^{149}Tm which have been obtained by extrapolation of known schemes of πhsub(11/2) nuclei are given. It is shown that a very promising candidate for proton emission is ^{150}Lu and possibly also the 10^+ isomeric level in ^{150}Yb.

45655 **(JINR—R-4-84-355) Problem of low energy neutron inelastic scattering on the ^{152}Sm nucleus.** Dias, Kh.R.; Mehndes, R.L.; Solorsano, R.K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701832.

Submitted to the journal Sov. J. Nucl. Phys. .

A study of inelastic neutron scattering by the nucleus ^{152}Sm at an incident energies of 2.47 and 2.75 MeV using the coupled channel method has been made. Consideration is made of the 2^+ (0.122 MeV), 4^+ (0.366 MeV) and 2^+ (1.086 MeV) excited states. It is shown that in this energy range the process may be described satisfactorily considering ^{152}Sm as a deformed nucleus with non-axial symmetry with account for the quadrupole and hexadecapole deformations. The scattering process through the compound nucleus is calculated according to the Hauser-Feshbach formula with width fluctuation correction. Excitation of the considered states as through compound nucleus or through direct process gives contribution to the total cross section of the considered reaction.

45656 **(JINR—R-4-84-475) Electric transitions from octupole states in ^{158}Dy and ^{168}Er nuclei.** Mikhajlov, I.N.; Usmanov, P.N.; Chariev, M.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701816.

The phenomenological model is used for the study of the characteristics of low-lying states of negative parity in ^{158}Dy and ^{168}Er. The spectra of octupole bands and reduced probability ratios of E1-transitions are discussed. Calculated level energies and B(E1) value ratios are compared with experimental ones and also with the results of microscopic model. The results of our model show that the simple phenomenological model describes the experimental data more satisfactorily than the microscopic model. Using the phenomenological model, firstly introduced for actinides, it is possible to obtain good results for rare earth region nuclei as well.

45657 Structure of ^{186}Ir and decoupling phenomena in doubly-odd deformed nuclei. Kreiner, A.J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Fisica; Brookhaven National Lab., Upton, NY (USA)); Digregorio, D.E.; Fendrik, A.J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Fisica); Davidson, J.; Davidson, M. (Buenos Aires Univ. Nacional (Argentina). Facultad de Ciencias Exactas y Naturales). *Nuclear Physics [Section] A;* **432**: No. 2, 451-474(14 Jan 1985).

States of ^{186}Ir, excited through several (HI, xn) reactions, were studied using in-beam γ-ray spectroscopy techniques. A completely new high-spin level scheme, comprising several rotational bands, is presented. The positive-parity ΔI = 2 ground-state band is possibly a first example of a hitherto unreported scheme called double decoupling associated with a proton and neutron both occupying Ω = 1/2 orbits of decoupling parameters larger than unity. A prominent ΔI = 1 negative-parity structure is interpreted as the π tilde hsub(9/2) x ν tilde isub(13/2) band known in Tl isotopes but in a prolate-deformed situation.

45658 Quadrupole moments of the 12$^+$ isomers in ^{188}Hg and ^{190}Hg. Dracoulis, G.D.; Lonnroth, T.; Vajda, S. (State Univ. of New York, Stony Brook (USA). Dept. of Physics); Kistner, O.C.; Rafailovich, M.H. (Brookhaven National Lab., Upton, NY (USA)); Dafni, E. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics); Schatz, G. (Konstanz Univ. (Germany, F.R.). Fakultaet fuer Physik). *Physics Letters, [Section] B;* **149**: No. 4/5, 311-315(20 Dec 1984).

The electric quadrupole interaction of the 12$^+$ isomers in ^{188}Hg and ^{190}Hg has been measured in solid Hg. The quadrupole moments deduced, vertical strokeQ[^{188}Hg(12$^+$)]vertical stroke = 91(11) e fm^2 and vertical strokeQ[^{190}Hg(12$^+$)]vertical stroke = 117(14) e fm^2 suggest a possible change in γ-deformation due to the rotation alignment of the isub(13/2) quasi-neutrons. The temperature dependence of the electric field gradient tensor in Hg was also determined.

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

45659 (DOE/ER/03346—264) I. Core-quasiparticle coupling model calculations as a test of IBA core descriptions of the even-mass Hg isotopes. II. Decay of mass-separated ^{203}At. Semmes, P.B. (Georgia Inst. of Tech., Atlanta (USA)). Jul 1985. Contract AS05-76ER03346. 157p. (ORO—3346-264). NTIS, PC A08/MF A01; GPO Dep. File Number DE85016956.

Thesis.

The Core-Quasiparticle Coupling Model (CQCM) for odd-mass nuclei, which is based on dynamical field theory and the Bardeen-Cooper-Schrieffer (BCS) method, has been applied to two problems. In the first, a study of Pauli exchange effects for the odd particle in the Interacting Boson-Fermion Model (IBFM) is made by a comparison with the CQCM. Spectra for a partly filled j-shell coupled to Interacting Boson Model cores are calculated in both models, and values of the IBFM exchange parameter A_0 are found which lead to spectra similar to those in the CQCM. In the second application, CQCM calculations have been performed for the i/sub 13/2/ bands in the odd-mass Hg isotopes, h/sub 9/2/ bands in the odd-mass Tl isotopes, and the h/sub 11/2/ bands in the odd-mass Au isotopes (A = 189 to 195). The even-mass Hg core descriptions were taken from previous proton-neutron Interacting Boson Model (IBM-2) calculations, and thus a comparison between the experimental and calculated level schemes for the odd-mass isotopes can be interpreted as a test of the core description. A predicted transition from positive Q(2$^+$) near A = 195 to negative Q(2$^+$) near A = 191 is not borne out by the odd-mass data. The radioactive decay of ^{203}At to ^{203}Po has been studied with mass-separated sources from the UNISOR facility. Time-sequenced spectra of γ-rays, x-rays, and conversion electrons have been obtained, together with γ-γ-t, γ-X-t, e$^-$-γ-t and e$^-$-X-t coincidence data. From this information, a decay scheme has been constructed, consisting of 30 excited states and 45 transitions that incorporate approximately 90% of the decay intensity assigned to ^{203}At. All excited states below 1 MeV have been assigned unique spin-parity values, and the observed level scheme can be qualitatively understood in terms of a particle-core weak coupling description. The ground-state decay energy has been deduced.

45660 (HMI-P—6/84-HF) Decay of the ground state and the 29/2$^+$ isomer in ^{217}Ac and G factor measurements by perturbed angular distribution of α-particles. Decman, D.J.; Grawe, H.; Kluge, H.; Maier, K.H.; Maj, A.; Roy, N.; Agarwal, Y.K.; Blume, K.P.; Guttormsen, M.; Huebel, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1984. 64p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752206.

The nucleus ^{217}Ac was studied using the ^{205}Tl(^{16}O, 4n), ^{206}Pb (^{15}N, 4n) and ^{209}Bi (^{12}C, 4n) reactions. The measurements included α-γ, γ-γ, α-ce and ce-ce coincidence experiments as well as γ-ray and α-particle perturbed angular distribution studies. Results are: g(^{217}Acsup(gs)) = +0.85 (1) and Tsub(1/2)(^{217}Ac sup(gs))=69(4) ns, the shortest known α-decay of a ground state. ^{217}Agsup(m) decays mainly by a γ cascade, but also by α-emission to the single particles states πhsub(9/2), fsub(7/2), isub(13/2) of ^{213}Fr. Spins and parities of levels to the 29/2$^+$ isomer at 2013 keV with Tsub(1/2)=740(40)ns and g=+0.347(5) are determined. The level scheme of ^{217}Ac and the α decay of N=128 isotones are discussed.

45661 (IPNO-DRE—84-34) High energy structures in heavy ion collisions: a multiphonon description. Chomaz, P.; Blumenfeld, Y.; Frascaria, N. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752040.

Energy spectra of fragments from the ^{36}Ar + ^{208}Pb reaction at 11 MeV/n exhibit structures at high excitation energies. These structures are interpreted in terms of target multi-phonon excitations built from giant resonances. The importance of such processes for the kinetic energy dissipation in heavy ion collisions is emphasized.

45662 (JINR—R-1-84-552) Total disintegration of lead nuclei by ^{12}C nuclei at 4.5 A GeV/c momentum. Vokal, S.; Karabova, M.; Mukhtorov, A.; Togoo, R.; Tolstov, K.D.; Tuchek, J.; Shumbera, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701855.

Experimental data on the total, disintegration of lead nuclei by ^{12}C nuclei are presented, and a comparison with ^{4}HePb-collisions at the same 4.5 x A GeV/c momentum is made. It is shown that inelasticity coefficients in these interactions depend essentially on the mass of a primary nucleus and weakly on the target mass. Correlations between different types of secondary charged particles in the azimuthal plane of ^{12}CPb-collisions (with Nsub(h) >= 50) are studied, and a comparison with calculations in the framework of the cascade evaporation model is made. The results obtained point to a possible manifestation of the hydrodynamic "bounce-off" effect.

45663 (Juel-Spez—280) Spectra of nuclei in the lead region in the framework of the RPA with OBE-G-matrix interactions. Kempis, A. von. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Nov 1984. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751877.

On the base of an existing Computer program for the calculation of particle-hole RPA matrix elements (especially) for finite-range interactions as well for the solution of the particle-hole RPA equations the corresponding matrix elements for two-particle respectively two-hole nuclei were calculated (and tested) and the corresponding RPA equations solved. For the calculation of the nuclear spectra meson-exchange G-matrix interactions were used instead of phenomenological approaches. The former constitute only a part of the effective NN interaction. A direct comparison with the experimental spectra is therefore just as little convenient as the calculation of transition probabilities or an evaluating comparison of

TDA and RPA. The results let nevertheless recognize following: (1) The density dependence of the effective NN interaction. (2) For the states of two-particle respectively two-hole nuclei the (π+rho) exchange plays no such dominating role as for unnatural-parity states in double-magic nuclei. (3) An approximation of the missing part of the effective NN interaction by delta-function interactions is not sufficient.

45664 **Fission-fragment kinetic-energy distributions from a two-dimensional Fokker-Planck equation.** Scheuter, F.; Gregoire, C. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)); Hofmann, H. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik); Nix, J.R. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Physics Letters, [Section] B;* **149**: No. 4/5, 303-306(20 Dec 1984).

We calculate the fission-fragment kinetic-energy distribution for the compound nucleus ^{213}At by simultaneously taking into account spreading in a stretching degree of freedom and fluctuations in a fission degree of freedom. This is done in terms of an approximate solution of a two-dimensional Fokker-Planck equation obtained by propagating gaussian bundles in momentum space. When compared as functions of nuclear temperature with experimental data, our calculated mean kinetic energies are in approximate agreement and our calculated variances are slightly too small.

45665 **Study of heavy element structure with in-beam α-, β- and γ-ray spectroscopy.** Meyer, R.A.; Decman, D.J.; Henry, E.A.; Hoff, R.W.; Mann, L.G.; Struble, G.L.; Ussery, L.E. (Lawrence Livermore National Lab., CA (USA)). pp 399-423 of Proceedings of the International symposium on in-beam nuclear spectroscopy held at Debrecen, Hungary, 14-18 May 1984. Vol. 2. Dombradi, Zs.; Fenyes, T. (eds.). Budapest, Hungary; Akademiai Kiado (1984). (CONF-840530—Vol.2).

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

The authors' in-beam superconducting conversion electron spectrometer and its use in a (t,p) proton-conversion electron coincidence mode is described. Several examples of completed and ongoing investigations are presented. These include: EO strength from the sup(238)U fission isomer; electromagnetic properties of the Jsup(π)=6sup(+) and 8sup(+) states of sup(210)Pb; single particle and cluster states of sup(213)Fr; the Jsup(π)=21/2sup(+) isomer in sup(197)Au and sup(199)Au; and the cluster states of sup(199)Au. Results of the study of odd-odd deformed sup(244)Am are presented. The latter results performed using neutron-capture gamma-ray and conversion electron techniques are compared to recent developments in the modelling of deformed odd-odd nuclei.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

45666 **(GSI—85-10-Prepr.) Superheavy elements.** Hermann, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. 20p. (CONF-850129—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751895.

From International symposium on radioactivity; Pune, India (8 Jan 1985).

The present paper reports on the most recent attempts to synthesize superheavy elements.

45667 **(GSI—85-16-Prepr.) Investigation of new neutron-rich isotopes at the GSI on-line mass separator.** Rykaczewski, K.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Larsson, P.O.; Rathke, G.H.; Roeckl, E.; Schardt, D.; Zganjar, E.F.; Bosch, U. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Mar 1985. 16p. (CONF-850173—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752087.

From 23. international winter meeting on nuclear physics; Bormio, Italy (21 Jan 1985).

We review experiments on neutron-rich isotopes, performed at the GSI on-line mass separator over the past four years.

45668 **(IAE—3824/2) Change of the conversion rate of E3 isomer of sup(235m)U (76.8 eV, $1/2^+ \rightarrow 7/2^-$) versus variation of valent zone configuration of atomic shell.** Grechukhin, D.P.; Soldatov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701835.

In the framework of the Hartry-Fock-Slater method calculation of a change in the lambda conversion rate of the E3 isomer (at a transition energy $h/2\pi\omega$=77 eV) relative to the lambda$_1$ for a normal atom configuration (7 s1/2)^2(6d3/2)^1(5f5/2)^2 has been carried out for 14 valent zone configurations of the uranium atomic shell involving considerable variations of 6d, 7s and 5f orbit population. Quite profound Δlambda/lambda$_1$ change versus variation of 5f-orbit population (ΔN(5f) not equal to 0) achieving approximately 8% for ΔN(5f)=+-1 has been discovered, which exceeds Δlambda/lambda$_1$ by an order with changes in population of other orbits (when N(5f)=const). In spite of the fact that a direct contribution of 5f-electrons to conversion is rather small (<=0.1%), variations ΔN(5f) of population of a highly localized 5f orbit lead to the same change in the screening effect of more extended 6p- and 6d-orbits, on which conversion mainly takes place. This phase coincidence effect explains strong total change in Δlambda/lambda$_1$ at ΔN(5f) not equal to 0. Strict correlation of a partial conversion rate with the orbit radius mean square has been found out for the 6p orbits.

45669 (IAEA-SMR—93, pp 117) **Mass, charge and kinetic energy distribution of fission fragments.** Nifenecker, H. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Published in summary form only.

45670 (IAEA-SMR—93, pp 119-171) **Nuclear data for fission reactor core design and safety analysis: Requirements and status of accuracy of nuclear data.** Rowlands, J.L. (UKAEA Atomic Energy Establishment, Winfrith). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

The types of nuclear data required for fission reactor design and safety analysis, and the ways in which the data are represented and approximated for use in reactor calculations, are summarised first. The relative importance of different items of nuclear data in the prediction of reactor parameters is described and ways of investigating the accuracy of these data by evaluating related integral measurements are discussed. The use of sensitivity analysis, together with estimates of the uncertainties in nuclear data and relevant integral measurements, in assessing the accuracy of prediction of reactor parameters is described. The inverse procedure for deciding nuclear data requirements from the target accuracies for prediction of reactor parameters follows on from this. The need for assessments of the uncertainties in nuclear data evaluations and the form of the uncertainty information is discussed. The status of the accuracies of predictions and nuclear data requirements are then summarised. The reactor parameters considered include: (a) Criticality conditions, conversion and burn-up effects. (b) Energy production and deposition, decay heating, irradiation damage, dosimetry and induced radioactivity. (c) Kinetics characteristics and control, including temperature, power and coolant density coefficients, delayed neutrons and control absorbers.

45671 (JAERI-M—84-010, pp 286-292) **Measurement of fast neutron induced fission cross sections of ^{232}Th, ^{238}U, ^{237}Np and ^{243}Am.** Kanda, Kazutaka; Sato, Osamu; Yoshida, Kazuo; Imaruoka, Hiromitsu; Terayama, Hiromichi; Yoshida, Masashi; Hirakawa, Naohiro (Tohoku Univ., Sendai (Japan)). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Neutron induced fission cross sections of ^{232}Th, ^{238}U, ^{237}Np and ^{243}Am relative to ^{235}U were measured in the energy range from 1.5 to 6.6 MeV. The present results are compared with experimental results of others and evaluated data in JENDL-2 and ENDF/B-IV.

45672 (JAERI-M—84-010, pp 293-302) **Measurements of the gamma-ray production cross section at Tohoku University.** Itagaki, Shinjiro (Tohoku Univ., Sendai (Japan)). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

A review is given on the measurements of the gamma-ray production cross section which have been carried out at Tohoku University using 4.5 MV Dynamitron accelerator. Finally the problems to be solved in future are briefly presented.

45673 (JAERI-M—84-010, pp 303-307) **Integral experiments for fission-product yield data.** Akiyama, Masatsugu; An, Shigehiro (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

The amount of the decay heat of fission products is known very sensitive to the basic fission yield data. Therefore, experiment of measuring the decay heat is one of good integral experiments to evaluate the fission yield data. From this viewpoint, the γ-decay heat of ^{235}U, ^{238}U and ^{232}Th following 14 MeV neutron fissions have been measured, and these data were compared with decay heat data for fast-neutron fissions and summation calculations.

45674 (JINR—D-7-83-644, pp 55-75) **Some problems of fusion and fission of heavy nuclear systems.** Oganesyan, Yu.Ts. 1983. (In Russian). NTIS (US Sales Only), PC A25/MF A01. File Number DE85781272. (CONF-830444—).

From International school-seminar on heavy ion physics; Alushta, USSR (14 Apr 1983).

Some aspects of fission and fusion of heavy nuclear systems are discussed. The mechanism of "cold" fusion of complex nuclei is investigated. The data of experiments on the production of isotopes with Z=105 and Z=107 during ^{209}Bi irradiation with sup(48,49,50)Ti ions and sup(206,207,208)Pb irradiation with ^{55}Mn ions are presented. Experiments on synthesis of 109 element and 108 element are considered. The results obtained prove that limitation in the method of "cold fusion" is determined by the mechanism of fusion of complex nuclear systems under conditions of strong Coulomb interaction of partners at all stages of collective motion from the moment of contact to the production of a compound nucleus.

45675 (JINR—E-4-84-446) **Nuclear decay by emission of charged particle-superasymmetric fission process.** Poenaru, D.N.; Ivascu, M.; Greiner, W.; Sandulescu, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 91p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85701836.

The macro-microscopic method, adapted for superasymmetric fission was applied to the alpha decay and other kinds of charged particles emission which are possible due to the nuclear shell structure. Three macroscopic models (the liquid drop model, the finite range of nuclear forces model and the Yukawa exponential model) are extended for nuclear systems with different charge densities. Various numerical methods for the computation of Coulomb and surface energy of a general shape nucleus are presented along with analytical results for some particular shapes. A phenomenological correction was used to obtain the experimental Q-value. This formalism was applied to the alpha decay from the ground state and from a fission isomeric state. A time dependent Hartree-Fock method is used to estimate the zero vibration energy. A new semiempirical formula giving the best estimates for the alpha decay lifetimes was derived and used to predict new alpha emitters. For this new mode of decay intermediate between alpha decay and the traditional fission, larger probabilities are obtained for the combinations of parent-nucleus-heavy cluster leading to a magic daughter nuclei or not too far from it.

45676 (JINR—R-4-84-326) **Decay of heavy nuclei with cluster emission.** Poehnaru, D.N.; Ivashku, M.; Sehndulesku, A.; Grejner, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701837.

The life-times of some heavy nuclei relative to the spontaneous emission of various clustors heavier then alpha particle are estimated with a model extended from the fission theory of alpha decay, showing that this phenomenon is a new manifestation of the nuclear shell structure. A large probability is obtained for the combinations "parent-heavy cluster" leading to a magic daughter or not too far from it. The analytical formula obtained allows one to handle large number of cases to search for new kinds of radioactivities.

45677 (JINR—R-6-84-422) **Search for superheavy in thermal waters of the Baikal rift zone.** Flerov, G.N.; Dmitriev, S.N.; Lomonosov, I.S.; Pinneker, E.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701839.

In searches for superheavy elements in nature the sample selection and development of the methods of SHE separation from these samples are the problems of primary importance. Bearing in mind the high volatility predicted for the sought elements and to simplify the methods of their concentration it is proposed to use low-mineralized thermal waters from the abyssal ruptures of the Baikal rift zone. The concentration methods used are sorption on cation-exchange and anion-exchange resins and on ampholytes with different functional groups. The spontaneous fission activity exceeding the background has been observed for certain samples of sulfacationides and the corresponding concentrates. The concentration of the spontaneously fissioning nuclide other than uranium in the thermal waters was estimated to bl 10^{-16} g/g. An assumption has been advanced that the spontaneously fissioning nucleide detected can be assigned to the region of superheavy elements. It has been noted that it can be alternatively assigned to an uncommon spontaneously fissioning isotope of known radioactive element (e.g, protactinium).

45678 (NEANDC(J)—96/U) **Evaluation of neutron nuclear data for ^{246}Cm and ^{247}Cm.** Kikuchi, Yasuyuki. (Japan Atomic Energy Research Inst., Tokyo). Jan 1984. 88p. (JAERI-M—83-236; INDC(JAP)—83/L). NTIS (US Sales Only), PC A05/MF A01. File Number DE84900755.

Neutron nuclear data of ^{246}Cm and ^{247}Cm have been evaluated. Evaluated quantities are the total, elastic and inelastic scattering, fission, capture, (n,2n), (n,3n) and (n,4n) reaction cross sections, the resolved and unresolved resonance parameters, the angular and energy distributions of the emitted neutrons, and the average number of neutrons emitted per fission. The fission cross section was evaluated mainly on the basis of measured data. The other cross sections were calculated with the optical and statistical models because of scarce measured data. Discussion is given on the nuclear model calculations.

45679 **Gamma branch from the sup(238)U shape isomer.** Kantele, J.; Stoeffl, W.; Ussery, L.E.; Decman, D.J.; Henry, E.A.; Estep, R.J.; Hoff, R.W.; Mann, L.G. (Lawrence Livermore National Lab., CA (USA)). pp 425-431 of Proceedings of the International symposium on in-beam nuclear spectroscopy held at Debrecen, Hungary, 14-18 May 1984. Vol. 2. Dombradi, Zs.; Fenyes, T. (eds.). Budapest, Hungary; Akademiai Kiado (1984). (CONF-840530—Vol.2).

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

The γ-ray decay of the sup(238)U shape isomer was reinvestigated using the sup(238)U(d,pn) sup(238)Usup(m) reaction with a

new two-detector technique. A line at 2512,7(5) and another possible one at 1877.6 keV are attributed to the isomer. The cross section for production of the 2512.7 keV γ ray by 18 MeV deuteron bombardment of sup(238)U is 42(12) μb, consistent with the authors' earlier conversion-electron work on sup(238)Usup(m).

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 45493, 45505, 45620, 45625, 45632, 45634, 45645, 45669

45680 (GANIL-P—84-07) Nuclear dynamics in phase space. Di Toro, M. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). Jul 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751164.

We present a unified semiclassical picture of nuclear dynamics, from collective states to heavy ion physics, based on a study of the time evolution of the Wigner distribution function. We discuss in particular the mean field dynamics, in this "quantal" phase space, which is ruled by the nuclear Vlasov equation. Simple approximate solutions are worked out for rotational and vibrational collective motions. Giant resonances are shown to be quite well described as scaling modes, which are equivalent to a lowest multipole (up to lsub(max)=2) distortions of the momentum distribution. Applications are shown to heavy ion physics to study giant resonances on high spin states and dynamical collective effects in subthreshold π-production. Several possible extensions and in particular the inclusion of two-body collision terms are finally discussed.

45681 (GSI—85-4-Prepr.) Composite particles and entropy production in relativistic nuclear collisions. Doss, K.G.R.; Poskanzer, A.M.; Renner, T.; Riedesel, H.; Ludewigt, B.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Loehner, H.; Ritter, H.G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1985. Contract AC03-76SF00098. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751893.

The particle production (p,d,t,^{3}He,^{4}He) was studied for 400 and 650 MeV/nucleon Nb + Nb and 400 and 1050 MeV/nucleon Ca + Ca. The chemical freeze out density of the participants and the entropy produced were deduced for each system. The chemical freeze out densities vary between 50 and 100% of normal nuclear density. The entropy production extrapolated for infinite nuclear matter is independent of target-projectile combination at 400 MeV/nucleon and changes little with increasing bombarding energy, but the absolute values are strongly model dependent. The low entropy, when compared to fireball calculations, indicate strongly that compression is present in the collisions. Therefore entropy values in principle can help in the determination of the equation of state for nuclear matter.

45682 (GSI—85-5-Prepr.) Subthreshold pion production in nucleus-nucleus collisions what is the mechanism. Shyam, R.; Knoll, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1985. 16p. (CONF-841259—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751889.

From International conference on nuclear physics; Bombay, India (27 Dec 1984).

Various reaction mechanisms proposed to explain the pion production at 'subthreshold' energies (below 290 MeV/A) are examined. They range from the nucleon-nucleon single collision mechanism to a co-operative multi-nucleon process. With a shell model prescription for the initial state energies the single collision picture can not explain the data. The participation of many nucleons in the pion production process appears to be necessary. We present a statistical model where the co-operative action of several of the target and projectile nucleons in the pion production process is invoked. We also consider the formation of the fragments in the final channel alongside the produced pion. Calculations performed within the model provide a good overall description of the experimental data over a wide range of beam energies and masses of the participating nuclei. Fragment formation in the final channel is seen to be vital to understand the experimental data within our model.

45683 (GSI—85-6-Prepr.) Isopin effects in pionic bremsstrahlung emitted from tin-isotopes. Uhlig, M.; Vasak, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jan 1985. 24p. (CONF-850141—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751890.

From 13. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (14 Jan 1985).

In heavy ion collisions one observes the production of pions far below the free nucleon-nucleon threshold. One model to explain that cooperative production mechanism is the bremsstrahlung model. In the context of that model we discuss whether the pion yield will significantly be influenced if one changes from tin targets with small neutron numbers to neutron rich tin targets. Based on our model of statistical isospin fluctuations we find out that - depending on geometrical assumptions - the effect can provide a significant enhancement of the pion yield up to 50%.

45684 (GSI—85-7-Prepr., pp 1-11) Unified model for dissipative heavy-ion collisions. Feldmeier, H. Feb 1985. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751912.

In Unified model for dissipative heavy-ion collisions. On the dynamics of the mass asymmetry.

The model which is outlined in the following is intended to describe collisions between nuclei whose relative velocity is much smaller than the Fermi velocity. Nuclear matter then is assumed to behave not much differently from ordinary nuclei, which means that the colliding system still forms a leptodermous object of uniform density distribution in the interior. Therefore, the macroscopic appearance of the nuclear system is characterized by a family of shapes with sharp surfaces, which are restricted to axial symmetry. The volume conserving shapes are uniquely determined by three macroscopic degrees of freedom which are a measure of the distance between the nuclei, of the neck and deformation, and of the mass asymmetry. In addition there are three rotational degrees of freedom for the intrinsic and relative rotation of the di-nuclear complex.

45685 (GSI—85-7-Prepr., pp 12-17) Dynamics of the mass asymmetry. Feldmeier, H. Feb 1985. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751912.

In Unified model for dissipative heavy-ion collisions. On the dynamics of the mass asymmetry.

In order to study the dynamics of the rearrangement in the mass number of two colliding nuclei we have performed trajectory calculations. The model uses a family of nuclear shapes which consists of two spheres joined smoothyl by a hyperboloid. For these shapes we calculated a mass tensor, a potential energy, and a friction tensor. The macroscopic variables are the relative distance, neck and deformation, mass asymmetry, and three angles of rotation.

45686 (GSI—85-7-Prepr.) Unified model for dissipative heavy-ion collisions. On the dynamics of the mass asymmetry. Feldmeier, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751912.

This report contains two articles concerning a unified model for dissipative heavy ion collisions, and the dynamics of the mass asymmetry. See hints under the relevant topics.

45687 (GSI—85-9-Prepr.) Theory of and effects from elastoplasticity in nucleus-nucleus collisions. Noerenberg, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Feb 1985. 17p. (CONF-8408139—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751892.

From INS-RIKEN international symposium on heavy ion physics; Tokyo, Japan (24 Aug 1984).

Elastoplasticity of finite Fermi systems results from a coherent coupling between collective and intrinsic degrees of freedom and subsequent equilibration essentially due to two-body collisions. Within a non-markovian transport-theoretical approach referred to

as dissipative diabatic dynamics (DDD), elastoplastical forms the link between giant vibrations and overdamped motion of nuclear. Obersvable effects resulting from this non-markovian behaviour in nucleus-nucleus collisions are discussed.

45688 (IAEA-SMR—93, pp 1-2) **Recent advances in understanding low-energy reactions.** Koonin, S.E. (California Inst. of Tech., Pasadena (USA). W.K. Kellogg Radiation Lab.). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Published in summary form only.

45689 (IAEA-SMR—93, pp 5-25) **Recent advances in nuclear model code developments.** Uhl, M. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Model calculations can be used to provide nuclear data for applications. Computer codes for the calculation of average cross sections are reviewed. The codes are discussed together with the models - the spherical and deformed optical model, the statistical compound nucleus model and phenomenological precompound models - and the required parameters.

45690 (IAEA-SMR—93, pp 27-37) **Application of nuclear model computer codes to nuclear data calculations.** Strohmaier, B. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

This paper has been prepared in close correlation with the preceding one (M. Uhl: Recent advances in nuclear model computer code developments) and is intended to describe more practical aspects of nuclear model calculations, namely the dependence of their results on the choice of the input parameters as well as on the way of treating certain physical aspects. The topics are restricted mostly to the precompound and compound model description of nucleon or light complex particle induced reactions at incident energies of a few to tens of MeV. The work is based on recent publications in the field and, as far as existing, own experience. In particular, it treats attempts of including angular momentum conservation to preequilibrium calculations and describes various models for calculating preequilibrium angular distributions. The influence of optical potentials and of level densities on statistical model calculations is discussed. Further, the applicability of approximations, particularly in connection with width fluctuation and angular momentum conservation, is investigated. Finally, some more general examples of neutron nuclear data evaluation are presented.

45691 (IAEA-SMR—93, pp 39-55) **Critical review of precompound models.** Jahn, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

It is shown that the desired predictive capability of much of the commonly used precompound formalism to calculate nuclear reaction cross-sections is seriously reduced by too much arbitrariness of the choice of parameters. The origin of this arbitrariness is analysed in detail and improvements or alternatives are discussed.

45692 (IAEA-SMR—93, pp 67-113) **Dynamical theories of nuclear fission, viscosity and dissipative effects.** Jensen, A.S.; Miranda, A. (Aarhus Univ. (Denmark). Inst. of Physics). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

A number of dynamical theories of nuclear fission are described. Their state of development, scope and complexity are very different. Special attention is devoted to viscosity and dissipation. One of the theories, the collective transport theory for nuclei also called the linear response theory, is of special interest. It is a general theory containing all necessary ingredients and the numerical results compare favorably with available experimental data.

45693 (IAEA-SMR—93, pp 115) **Static theories of the fission barrier.** Brack, M. (Regensburg Univ. (Germany, F.R.)). Apr 1984. NTIS (US Sales Only), PC A15/MF A01. File Number DE85781405. (CONF-820163—Pt.1).

From Winter college on nuclear physics and reactors; Trieste, Italy (25 Jan 1982).

Published in summary form only.

45694 (INIS-mf—9306, pp J15) **Boost-invariant Boltzmann-Vlasov equations for relativistic quark-antiquark plasma.** Bialas, A. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Uniwersytet Jagiellonski, Krakow (Poland). Inst. Fizyki); Czyz, W. (Institute of Nuclear Physics, Krakow (Poland)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45695 (INIS-mf—9306, pp I26) **Nuclear sizes and densities of 1 fsub(7/2)-nuclei from pionic atoms and elastic scattering of α particles.** Gils, H.J.; Rebel, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik 3); Friedman, E. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45696 (INIS-mf—9306, pp I29) **Contribution of the induced interaction to (g'$_0$)sub(ΔN).** Desplanques, B. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45697 (INIS-mf—9306, pp I34) **Deuteron and ^{3}He wave functions from precision measurements of relativistic nuclei fragmentation.** Ableev, V.G.; Dimitrov, K.; Filipkowski, A.; Kobushkin, A.P.; Nikitin, D.K.; Nomofilov, A.A.; Piskunov, N.M.; Sharov, V.I.; Sitnik, I.M.; Strokovsky, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45698 (INIS-mf—9306, pp I51) **High-energy spin-isospin modes in nuclei.** Chanfray, G. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik); Ericson, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; European Organization for Nuclear Research, Geneva (Switzerland)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45699 (INIS-mf—9306, pp I53) **Consistent description of spin isospin excitations in nuclei.** Czerski, P.; Dickhoff, W.H.; Faessler, A.; Muether, H. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45700 (INIS-mf—9306, pp I23) **Δ resonance excitation in nuclei by (^{3}He,t) reactions.** Ellegaard, C.; Gaarde, C.; Larsen, J.S.; Peterson, R. (Niels Bohr Inst., Copenhagen (Denmark)); Goodman, C. (Indiana Univ., Bloomington (USA)); Bergqvist, I.; Brockstedt, A.; Carlen, L.; Ekstroem, P. (Lund Univ. (Sweden). Fysiska Institutionen); Bachelier, D. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45701 (INIS-mf—9335) **Influence of the beta strength function on reactor and neutrino physics.** Metzinger, J. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1984. 85p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781549.

In this thesis the rates for β-delayed neutron emission and fission are calculated by using the beta strength functions between stability value and neutron drip line determined earlier in connection with the calculation of the β^- halflives. The results are applied for the calculation of the after-heat coming forward after shut down of reactors. In order to determine the isotope quantities in the reactor core as function of the reactor operation time the computer code THOR-1 was developed. By this time-dependent calculations of the β- and γ-afterheat after a reactor shut down and electron and antineutrino spectra in the reactor core are performed. Radiative corrections were regarded. The afterheat functions are in excellent agreement with measurements for the thermal fission of ^{239}U and sup(239,241)Pu. It is expected that also the after-heat of further fissile materials can be reliably predicted. By this a great advance for the design of emergency cooling systems for light water reactors is reached. The calculated electron and antineutrino spectra fullfil for the first time the required accuracy for the analysis of reactor-neutrino oscillation experiments and will be especially of importance for the current experiments on power reactors. It has to be stressed, that it has succeeded for the first time to describe consistently by a unified description of the beta decay the after-heat of reactors, electron and antineutrinos as well as halflives. As astrophysical application the response probability for the Ga-detector discussed for detection of galactic neutrinos is calculated.

45702 (INIS-mf—9697) **Contributions to the phenomenological study of the rotational bands of even-even and even-odd nuclei.** Sabac, C. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1983. 19p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701811.

Summary of a doctorate thesis.

New theoretical results obtained in the frame of coherent states model are presented, proving model power in describing unitarily the spectroscopic properties of even-even and even-odd nuclei in the rare-earths area both in the vibrational boundary and where the energetic split points out a rotational behaviour. These results are: A. The study of high state energy: a) analytical forms for excitation energies within the ground band and for three bands interacting at strong deformations are obtained; b) quadrupolar degrees of freedom couplings with other degrees of freedom have been studied. For example: particle type degrees of freedom (for which analytical formulae are obtained for decoupled band energies using only the ground band states for the core space; the odd nucleon also couples the β band by means of ground band for the stable β even-odd nuclei; the nucleon is coupled to the joint movement of the core described by β and γ ground bands for instable γ nuclei), octopolar degrees of freedom. We have elaborated a model to describe O^- and 1^- negative polarity bands. For all the cases mentioned above, electromagnetic transition probabilities are studied. B. For each case, the formalism is also applied by extensive numerical applications revealing a very good agreement with the experimental data.

45703 (INIS-mf—9707) **Theory of nuclear reactions, with applications to heavy ion scattering reactions.** Youssef, M.S.A. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1981. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701820.

Summary of a doctorate thesis.

Nuclear science to day, has gained its stature through the pioneer work of both theorists and experimentalists within its two main divisions, Nuclear Reaction and Nuclear Structure theories. Our main interest in this theoretical work in nuclear reaction theory is focused on three topics, come under the headings of three parts which are the constituents of the present paper. Part 1 is concerned with "Contributions to the theory of Threshold phenomena in nuclear reactions; cluster threshold states in heavy ion reactions". Part II is devoted to "Hermiticity of the Laplacian operator, R-matrix theories and direct interaction theory", while part xII is ascribed to "Heavy ion transfer reactions and scattering". The aforementioned selected topics are the backbones of this thesis, which starts with general introduction giving a brief account about the material included in. In each part, investigations are given in an extended manner through several chapters. Finally, the thesis is ended eith the chapter on "General Discussions and Conclusions". Appendices, references, and figure captions are found at the end of each part, the matter which we believe to facilitate much the reading through of the thesis. The first two parts are based (to some extent) on the same formal background (R-matrix, Kapur-Peierls-theories) and they converge to solve some physical problems originating from flux conservation laws in nuclear reactions, while the third part is indirect related to the first two; in principle it joins the other two parts under computational aspects. All of them after all, form the solidarity of the material included in the thesis.

45704 (IPNO-TH—83-32) **Influence of left right asymmetry degrees of freedom in self-consistent calculation of ^{20}Ne.** Marcos, S.; Flocard, H.; Heenen, P.H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751161.

Within a constrained Hartree-Fock calculation we investigate the effects of left right asymmetric degrees of freedom associated with the channel ^{16}O + ^{4}He <-> ^{20}Ne. We find a large softness of ^{20}Ne against octupole deformation. The optimal solution after restoration of the parity by means of a projection shows a pronounced ^{16}O + ^{4}He clustering. A generator coordinate calculation along the collective path confirms this conclusion. Once center of mass motion effects are taken into account a good agreement with experiment is found.

45705 (ISN—83-02) **Semiclassical description of rotating nuclei.** Durand, M.; Kunz, J.; Schuck, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jan 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751211.

The technique of partial h-resummation is used to obtain semiclassical, i.e. average current distributions in the body fixed system of heavy nuclei. It thereby turns out that this average intrinsic current only flows in the nuclear surface. A Strutinsky smoothing of the current is also performed and gives nice agreement with the semiclassical results. We also show how one can incorporate superfluidity into the semiclassical treatment. To lowest order in h we find that the moment of inertia of superfluid nuclei is zero. The same result is obtained by a quantum mechanical calculation if the gap goes to infinity. The importance of including n-corrections is pointed out.

45706 **(ITF—84-64-R) Generating matrix elements of the potential energy operator of light and intermediate mass nuclei on the basic function of the SU(3) model.** Tereshin, Yu.V.; Filippov, G.F. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701813.

The effective Hamiltonian for the s-d-shell nuclei is constructed within the SU(3) model with real nucleon-nucleon interaction. This Hamiltonian is defined in the space, where the wave function is mapped in SU(3) tensor, formed of two mutually orthogonal three-dimensional vectors.

45707 **(JINR—E-4-84-487) Intensified and asymmetric barrier penetration of nuclear slabs in time-dependent Hartree-Fock approximation.** Maedler, P.; Nikishov, P.Yu.; Zakhar'ev, B.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701827.

The effects of intensified and asymmetric barrier penetration by complex particles exhibiting intrinsic structure are investigated in the framework of the time-dependent mean-field theory using an effective one-dimensional layer geometry and a simplified Skyrme nucleon-nucleon effective interaction. The transmission coefficient D(E) has been investigated as a function of incident energy E anU layer thickness. The appearance of discontinuities in D(E) is discussed in detail. It is argued that quantum corrections to the standard TDHF picture as well as the transition to three dimensions possibly smearing out the discontinuities should not alter the qualitative results. In nearly all considered cases the penetrability is really substantially intensified and the asymmetry effect manifests itself as predicted earlier using a simple quasideuteron model.

45708 **(JINR—E-7-84-415) TDHF-motivated macroscopic model for heavy ion collisions: a comparative study.** Biedermann, M.; Reif, R.; Maedler, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701829.

A detailed investigation of Bertshc's classical TDHF-motivated model for the description of heavy ion collisions is performed. The model agrees well with TDHF and phenomenological models which include deformation degrees of freedom as well as with experimental data. Some quantitative deviations from experiment and/or TDHF can be removed to a large extent if the standard model parameters are considered as adjustable parameters in physically reasonable regions of variation.

45709 **(LA—10438-C) LAMPF workshop on Dirac approaches to nuclear physics: proceedings.** Shepard, J.R.; Cheung, C.Y.; Boudrie, R.L. (eds.). (Los Alamos National Lab., NM (USA)). May 1985. Contract W-7405-ENG-36. 412p. (CONF-850163—). NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85016203.

From Workshop on Dirac approaches to nuclear physics; Los Alamos, NM, USA (31 Jan 1985).

Separate abstracts were prepared for 20 papers in this proceedings. Two other papers were previously abstracted for EDB. (LEW)

45710 **(LYCEN—8364) Charged pion electroproduction and spin-isospin modes in nuclei.** Chanfray, G. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752036.

We study photopionic nuclear processes in the quasielastic region. We show how charged pion electroproduction allows the simultaneous access to the transverse and longitudinal spin-isospin responses. Gauge invariance requirements are taken into account in a coherent way with the various medium effects.

45711 **(LYCEN—8403) High energy spin isospin modes in nuclei.** Chanfray, G.; Ericson, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jan 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752035.

The high energy response of nuclei to a spin-isospin excitation is investigated. We show the existence of a strong contrast between the spin transverse and spin longitudinal responses. The second one undergoes a shadow effect in the Δ region and displays the occurrence of the pionic branch.

45712 **(PB—85-186484/XAB) Angular correlations in heavy-ion reactions.** Marsh, S.; Rae, W.D.M. (Oxford Univ. (UK). Nuclear Physics Lab.). 1984. 15p. NTIS, PC E03/MF E03.

Properties of the in-plane correlation between the initial scattering angle and the angle at which subsequent particle decay occurs, following a forward angle heavy-ion reaction are examined. The results are obtained in the strong absorption limit. In particular, the authors explain the recent experimental observation that there is a systematic dependence of the correlation distributions on the initial scattering angle of the excited nucleus. They generalize this result to the case of nuclei with non-zero spins in the decay channel, and also obtain closed-form expressions for the correlation function under general matching conditions.

45713 **Correlations between preequilibrium nucleons.** Ernst, D.J.; Strayer, M.R.; Umar, A.S. (Physics Department, Texas A & M University, College Station, Texas 77843). *Physical Review Letters;* **55**: No. 6, 584-587(5 Aug 1985). Contract AC02-76ER03074.

A quantum-mechanical model for the emission of fast nucleons in low-energy nucleus collisions is presented. The role of a classical emission function is shown to be played by the time derivative of an impact-parameter—integrated, time-dependent, distorted-wave Wigner function. Correlations between the emitted particles are shown to be caused by the Pauli principle, by the impact-parameter dependence of the emission process, and by two-body collisions including the final-state interactions, as well as those due to the size of the emitting source.

45714 **Experimental physics of dynamical supersymmetry in nuclei.** Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). *Physica D: Nonlinear Phenomena (Amsterdam);* **15**: No. 1/2, 99-111(Jan 1985).

Supersymmetry ideas for nuclei are outlined in the context of traditional models. Following this, a detailed discussion of the structure of two types of nuclear supersymmetry schemes, based on the U(6/4) and U(6/12) supergroups, is given along with an explanation of the appropriate empirical probes for testing each scheme. The experimental evidence for supersymmetry in nuclei is presented with emphasis on areas of both agreement and disagreement and with a discussion of alternate schemes that can reduce the latter.

45715 **Spin-orbit interaction in strongly deformed nuclides.** Chasman, R.R.; Wilkins, B.D. (Argonne National Lab., IL (USA). Chemistry Div.). *Physics Letters, [Section] B;* **149**: No. 6, 433-435(27 Dec 1984).

Mass yields observed in asymmetric fission are used to constrain the parameterization of the spin-orbit term of the neutron single particle potential at large deformations.

45716 **High nuclear temperatures by antimatter-matter annihilation.** Strottman, D.; Gibbs, W.R. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Physics Letters, [Section] B;* **149**: No. 4/5, 288-292(20 Dec 1984).

Using two rather different approaches the temperature of nuclear matter has been calculated as a function of the momentum of incident antiprotons and antideuterons. The results of this study show that a high temperature can be achieved by raising the beam momentum above 2 GeV/c. For incident momentum of the order of 6 GeV/c, temperatures of the magnitude necessary to study the possible quark-gluon plasma phase transition are reached.

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REFER ALSO TO CITATION(S) 44285, 45386, 45391, 45392, 45399, 45407

45717 (AECL—7988) Thermal neutron source study. Holden, T.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). May 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701933.

The value of intense neutron beams for condensed matter research is discussed with emphasis on the complementary nature of steady state and pulsed neutron sources. A large body of information on neutron sources, both existing and planned, is then summarized under four major headings: fission reactors, electron accelerators with heavy metal targets, pulsed spallation sources and 'steady state' spallation sources. Although the cost of a spallation source is expected to exceed that of a fission reactor of the same flux by a factor of two, there are significant advantages for a spallation device such as the proposed Electronuclear Materials Test Facility (EMTF).

45718 (AECL—8176) Absorption factor tables for x-ray and neutron scattering in cylindrical samples. Sears, V.F. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Oct 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85701934.

This report contains a more accurate and extensive tabulation of absorption factors for the scattering of X-rays or neutrons in cylindrical samples than has previously been published. In particular, we include for the first time values for use in the analysis of neutron inelastic scattering experiments where the absorption coefficients for the incident and scattered neutrons are not equal. A detailed account of the calculations, together with the development of a useful asymptotic expression for the absorption factor, will be published elsewhere.

45719 (CEA-CONF—7223) Radiative transfer equation accretiveness. Mercier, B. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Feb 1983. 43p. (In French). (CONF-8402150—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751185.

From Ecole Normale Superieure seminar on MA; Paris, France (29 Feb 1984).

Equations of radiative transfer in fixed matter are shown to verify, under hypothesis frequently verified in applications, accretiveness properties and maximum principle. A criterium of time step for the standard explicit scheme, then for an algorithm derived from Fleck and Cummings.

45720 (CEA-CONF—7337) Half-space problem for a transport equation issue from a radiative transfer problem. Sentis, R. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). May 1984. 2p. (In French). (CONF-8405332—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751184.

From Congress on numerical analysis; Bombannes, France (21 May 1984).

Published in summary form only.

45721 (CEA-N—2388) Transport equation solving methods. Granjean, P.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1984. 270p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85751199.

This work is mainly devoted to Csub(N) and Fsub(N) methods. CN method: starting from a lemma stated by Placzek, an equivalence is established between two problems: the first one is defined in a finite medium bounded by a surface S, the second one is defined in the whole space. In the first problem the angular flux on the surface S is shown to be the solution of an integral equation. This equation is solved by Galerkin's method. The Csub(N) method is applied here to one-velocity problems: in plane geometry, slab albedo and transmission with Rayleigh scattering, calculation of the extrapolation length; in cylindrical geometry, albedo and extrapolation length calculation with linear scattering. Fsub(N) method: the basic integral transport equation of the Csub(N) method is integrated on Case's elementary distributions; another integral transport equation is obtained: this equation is solved by a collocation method. The plane problems solved by the Csub(N) method are also solved by the Fsub(N) method. The Fsub(N) method is extended to any polynomial scattering law. Some simple spherical problems are also studied. Chandrasekhar's method, collision probability method, Case's method are presented for comparison with Csub(N) and Fsub(N) methods. This comparison shows the respective advantages of the two methods: a) fast convergence and possible extension to various geometries for Csub(N) method; b) easy calculations and easy extension to polynomial scattering for Fsub(N) method.

45722 (CEA-N—2410) Some modelisation aspects of the instrumental transformation of neutron kinetic energy into electrical impulse amplitude. Becker, A.; Lame, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 69p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751216.

The differential energy characterisation of neutron emission or fluxes may be called difficult especially when an approach to metrological standards is required. The use of somewhat complex computing programmes is unavoidable here since the process of selective detection and interpretation of measurement results involves: - Firstly of need to simulate by so-called MONTE CARLO techniques the responses of the various kinds of detector used (the detector responses are so dependent on changes in the environment that experimental calibration -too expensive to be easily repeated from one situation to the next- cannot be recommended); - secondly the need to answer pratically (in a discretized situation by matrix manipulations) to the problem, theoretically without a unique analytical solution, of resolving a Fredholm equation of the first kind. For the understanding, use and as necessary modification of the appropriate codes it is most important to have a very precise conceptual view of the mechanisms involved (in the sequence of direct instrumental transformations). For didactic purposes the present article attempts in a very simple case to give an idea, at increasing levels of complexity: stylisation, schematisation, modelisation, simulation, of the successive stage (neutron-proton energy transfer, analog conversion of ionising particle energy into electric impulse signal size) involved in the formation and understanding of an energy spectrum of recoil nuclei. All these instrumental distortions are made explicit in a kind of underlying two-dimensional "density"; in its discretized form this is called the instrumental transfer matrix and its understanding and treatment are the "keys" to the deconvolution of the recorded spectrum, giving access to the differental distribution of the emitted neutron energies.

45723 (CONF-8409264—1) Intense e-beam interaction with matter. Ritchie, R.H.; Crawford, O.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017093.

From Navy CPB material interaction workshop; Silver Spring, MD, USA (24 Sep 1984).

This document describes work done in this period on certain nonlinear processes of potential importance at high energy densities in condensed matter, and on the theory of the electron slowing-down-cascade spectrum engendered in solids by e-beams.

45724 (CTA-IEAV-NT—03/84) Benchmarks with diffusion theory and transport theory. Cunha Menezes Filho, A. da; Souza, A.L. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1984. 36p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85701993.

The multiplication factor and some spectral indices for five critical assemblies (ZPR-6-7, ZPR-3-11, GODIVA, BIG-TEN and FLATTOP) are calculated by Diffusion and Transport Theory, with group constants generated by MC^2 (for diffusion calculations) and by NJOY (for transport calculations). The discrepancies encountered in the ZPR-6-7 spectra, can be tracked to the large differences in the elastic cross section for Iron, calculated by MC^2 and NJOY.

45725 **(KFK—3812) Interactive FORTRAN program for the evaluation of structure factors and pair distribution functions from neutron diffraction experiments.** Abel, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik). Feb 1985. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752101.

IBM/3033.

This report describes an interactive program to evaluate neutron diffraction data using the Graphic System (GS) under MVS (TSO). Different evaluation steps may be directed by a CLIST. The present program is limited to cylindrical sample geometry. From the fully corrected static structure factor the pair correlation function g(r) and the radial density function may be calculated from which the mean coordination number can be obtained by numerical integration over the main peak. Producing a hardcopy output on a mechanical plotter is provided.

45726 (LA—10227-C-Vol.2, pp 384-400) **Neutron inelastic scattering from mixed valence materials.** Murani, A.P. (Institut Laue-Langevin, Grenoble, France). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Paramagnetic scattering from mixed valence materials is reviewed. Some of the early measurements identified a broad quasielastic spectral distribution (e.g. a Lorentzian centered on zero energy with large, practically Q-independent widths (half-width ~5-30 MeV) which remain finite as T → OK. More recent measurements using high energy neutrons on several mixed valance systems reveal inelastic peaks superposed on the broad quasielastic spectrum at low temperatures. These inelastic peaks progressively melt away with increasing temperature, accompanied possibly by some softening, and disappear almost completely around the temperature of the maximum in the susceptibility. Several possible mechanisms could semi-qualitatively account for the observed spectral response, a deeper insight into whose origin would aid in understanding the mixed valence phenomena.

45727 (LA—10227-C-Vol.2, pp 401-414) **Theoretical study of neutron scattering cross sections in semiconductors.** Cooke, J.F.; Blackman, J.A.; Morgan, T. (Oak Ridge National Lab., TN). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2). Contract W-7405-ENG-26.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The development of high-flux high-energy pulsed-neutron sources makes it possible to study electronic transitions in solids which are in the electron volt range. A theoretical study has been carried out to determine the feasibility of using such sources to obtain information about the band structure of semiconductors. Calculations of the inelastic neutron scattering cross sections for germanium and silicon based on an empirical pseudopotential description of the energy bands have been completed. No significant structure associated with the band gap was found in the calculational results. The calculated cross sections also were found to be quite small for realistic experimental conditions. Measurement of these relatively small cross sections could, however, provide important information about the band structure of semiconductors which cannot be obtained from most other experimental techniques.

45728 (LA—10227-C-Vol.2, pp 416-429) **Momentum distributions.** Simmons, R.O. (Univ. of Illinois, Urbana). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2). Contract AC02-76ER01198;W-31-109-ENG-38.

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The content of the portion of the workshop concerned with momentum distributions in condensed matter is outlined and the neutron scattering approach to their measurement is briefly described. Results concerning helium systems are reviewed. Some theoretical aspects are briefly mentioned.

45729 (LA—10227-C-Vol.2, pp 493-511) **Measurement of momentum distributions in solids using deep inelastic neutron scattering.** Reiter, G. (Univ. of Houston, TX). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The impulse approximation limit is shown to be well obtained for scattering from solids at energies presently available in pulsed neutron sources, and some results on the effect of hard cores in the approach to the impulse approximation in the fluid are presented. A method of inverting the Radon transform that relates S(q,omega) to the momentum distribution in this limit is given that is well suited to the physical situation in solids. When the scattering is from light ions in a heavy lattice, it is possible to obtain a direct measurement of the potential surface of the light ion.

45730 (LA—10227-C-Vol.2, pp 512-538) **Momentum distribution of light atoms by deep inelastic neutron scattering.** Taylor, A.D. (Rutherford Appleton Lab., Chilton, England). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

The development of deep inelastic neutron scattering, where neutrons of one eV or more are used to achieve momentum transfers in the impulse limit, is outlined. Scattering data from light atoms at high momentum transfers are presented and the results discussed.

45731 (LA—10227-C-Vol.2, pp 540-547) **High energy phonons: overview.** Eckert, J. (Los Alamos National Lab., NM). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Neutron scattering has been important in the measurement and interpretation of phonon dispersion relations. As these measurements are extended to higher energies they may yield new types of information or information about different types of systems. Several examples are discussed including: dispersion in high frequency internal modes, application to molecular crystals and the use of vibrational modes of hydrogen as a structural probe.

45732 (LA—10227-C-Vol.2, pp 611-625) **Scattering of electron-volt neutrons by light and heavy water.** Soper, A.K.; Taylor, A.D. (Univ. of Guelph, Ontario). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

In a recent experiment to determine the structure of liquid water the time-of-flight neutron diffraction cross sections for light and heavy water were measured at neutron energies up to 100eV, and at three scattering angles, i.e. 40°, 90° and 150°. At energies below 1 eV the curves for heavy water show the usual series of interference oscillations arising from inter-atomic correlations. The same oscillations are not apparent in light water because of the large proton incoherent cross section for neutrons. Plotted versus energy data reveal other features which have not been reported before. In particular for neutron energies in the range 0.2-1.0 eV the cross sections show a distinct bulge, particularly at the larger scattering angles. The neutron energy for the onset of this feature is the same at all angles, although the size of the bulge is angle dependent. There is a similar feature in the neutron energy region of 1-~50 eV. Subsequently the data fall with increasing energy. Although the behavior of the cross sections with neutron energy is not fully understood at present, detailed computer simulations with a simple harmonic oscillator model scattering law indicate that the bulge starting at ~0.2eV is caused in part by the onset of vibrational excitation of the molecule - a consequence of the complicated kinematic relationships involved in a time-of-flight experiment.

45733 (LA—10227-C-Vol.2, pp 626-645) **Neutron scattering, electronic excitations and chemical reactions.** Egelstaff, P.A. (Univ. of Guelph, Ontario). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Recent experiments have suggested that the scattering of neutrons in the 1-10 eV range by heavy water yield data which are anomalous relative to theoretical results based on the short collision time approximation for free, harmonically vibrating molecules. It is pointed out here that these data may be explained if the spectral density function has about 10% of its area in 1-2 eV range. This observation suggests that these data are sensitive to electronic excitations and/or chemical reactions in liquid water, which are promoted by the neutron scattering event and therefore may be studied through detailed S(q,omega) measurements.

45734 (LA—10227-C-Vol.2, pp 648-651) **Notes from impressions talk given at closing session of high energy excitations in condensed matter workshop.** Elliott, R.J. (Univ. of Oxford, England). Dec 1984. NTIS, PC A15/MF A01. File Number DE85007395. (CONF-840264—Vol.2).

From Workshop on high energy excitations in condensed matter; Los Alamos, NM, USA (13 Feb 1984).

Important applications of neutron scattering which were discussed at the workshop are summarized. These include: atomic structures, atomic motions and electronic motions. A brief comparison to results of photon processes is given.

45735 **(PB—85-186096/XAB) Numerical solution of field theories using random walks.** Barnes, T.; Daniell, G.J. (Rutherford Appleton Lab., Chilton (UK); Southampton Univ. (UK)). [1985]. 27p. (RAL—84-106). NTIS, PC E04/MF E04.

Prepared in cooperation with Southampton Univ., England.

It is shown how random walks in function space can be employed to evaluate field theoretic vacuum expectation values numerically. Specific applications which are studied are the two-point function, mass gap, magnetization (phi0 and classical solutions). This technique offers the promise of faster calculations using less computer memory than current methods.

6550 Medical Physics

REFER ALSO TO CITATION(S) 45011, 45230, 45231, 45255

45736 **(CEA-R—5271) Analysis of β, X, and γ emitting nuclides in radioactive mixtures; results of interlaboratory tests R15, R16, R17 and R18.** Morel, J.; Dalmazzone, J.; Chauvenet, B.; Thomas, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 72p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85751217.

Every year, the "Laboratoire de Metrologie des Rayonnements Ionisants" organises several interlaboratory tests to ensure the cohesion of radiation measurements at a national level. In 1982, four radioanalysis tests were proposed. Two of them dealt with the identification and dosage in activity per gram of β and γ emitters in complex mixtures, the third one with the measurements of photon emission fluxes per gram of the main γ-rays emitted by a europium 152 solution, the last one with the measurement of the emission fluxes per gram of the X and low-energy γ-rays of a mixed solution and the dosage of the corresponding radionuclides. The rather high participation in these tests shows they are of prime interest for measurement laboratories. This document is the synthesis of the results received. It begins with a short description of samples, measuring devices, measuring conditions and data-processing methods.

45737 **(CEA-R—5276) Quick evaluation of the neutron dose following a criticality accident by measurement of sodium 24 activity.** Tabardel, R.; Ricourt, A.; Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jul 1984. 36p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85751198.

In order to quickly sort out the irradiated individuals following a criticality accident, the neutron dose can be evaluated quickly by measuring the sodium-24 activity induced in the human body. The report supplies the information necessary for this evaluation from the response of various detectors of current use in radiation protection. The first part describes the method of evaluation of sodium-24 activity (A) given by the reading (M) of each instrument. The second part describes the method of kerma evaluation from the measured sodium-24 activity. The third part is an experimental application of the method of kerma evaluation from the sodium-24 activity measured in a phantom irradiated in the SILENE reactor flux. The results given by radiation protection instruments are in good agreement with the calculated values for a front exposure and demonstrate the usefulness of measuring the induced sodium-24 activity by radiation protection instruments of current use.

45738 **(FRNC-TH—1899) Analysis and development of methods of correcting for heterogeneities to cobalt-60: computing application.** Kappas, K. (Toulouse-3 Univ., 31 (France)). Nov 1982. 199p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85751173.

The purpose of this work is the analysis of the influence of inhomogeneities of the human body on the determination of the dose in Cobalt-60 radiation therapy. The first part is dedicated to the physical characteristics of inhomogeneities and to the conventional methods of correction. New methods of correction are proposed based on the analysis of the scatter. This analysis allows to take account, with a greater accuracy of their physical characteristics and of the corresponding modifications of the dose: "the differential TAR method" and "the Beam Substraction Method". The second part is dedicated to the computer implementation of the second method of correction for routine application in hospital.

45739 **(FS—83-31-AKA) Hints concerning the instruction of personnel in accordance with section 39 of the Radiation Protection Ordinance.** (Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.)). Feb 1983. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751869.

According to the Radiation Protection Ordinance, expert knowledge is demanded only for the person in charge of and responsible for radiation protection. Instructions of the personnel are therefore of special importance in this regard. Apart from legal aspects, the personnel is to be instructed on working techniques, possible hazards, exceptional radiation exposures, and safety and protection measures to be applied. The group of persons to be instructed comprises persons occupationally exposed to radiation.

45740 **(INFO—0101) Practical reference - radiation standards in Canada.** (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1983. 72p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701971.

In developing a policy that will require licensees to calibrate their radiation dose measuring devices and trace such calibrations to approved reference standards, the AECB has consulted recognized experts. This document presents the experts' reports and recommendations which will be considered in finalizing the policy.

45741 **(PTB-FMRB—101) Dosimetric quantities in the ICRU sphere for neutron irradiation with energies between thermal and 20 MeV.** Hollnagel, R.; Jahr, R.; Siebert, B.R.L. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Forschungs- und Messreaktor). Feb 1985. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752126.

The doses and dose equivalents produced in the ICRU sphere by broad unidirectional and monoenergetic neutron beams of energies between thermal and 20 MeV are calculated. The program employed makes use of the Monte Carlo method. In particular, the results for proposed operational radiation protection quantities (RPQ), i.e. specified-depth dose equivalent and ambient dose equivalent, are given. Quality factors, including those with and without induced photons, were derived for the proposed RPQ. Angular distribution factors for the irradiation of the ICRU sphere by

beams other than a broad unidirectional beam are also presented. In Appendix A the relation of the proposed RPQ to those hitherto (ICRP 21) used is discussed. The tabulated dose equivalents in several depths of the ICRU sphere may be used as conversion factors in radiation protection when the ICRP 21 values are superseded by the proposed operational quantities.

6560 Solid-state Physics

REFER ALSO TO CITATION(S) 44649, 44716, 44722, 44987

45742 **(CEA-CONF—7007) Principles of μSR technics.** Chappert, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). May 1983. 25p. (In French). (CONF-8305276—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751149.

From Conference on muon plus spectroscopy; Aussois, France (16 May 1983).

Principles of muon spin rotation spectroscopy (μSR) are presented. Muons plus are only take into account because physical and chemical results obtained presently are obtained by them. Muon plus has two main characteristics when implanted in a sample: just, it can be considered as a interstitial site probe; then the muon plus can diffuse. Accordingly the quantities measured by μSR are a combination of static and dynamic properties of the muon plus and of the sample. A fluid characteristics is the possibility of munomium formation (μ^+e^- bound state).

45743 **(DOE/ER/12061—3) High pressure electron resonance studies of electronic, magnetic, and structural phase transitions. Final technical report, May 1, 1982-April 30, 1984.** Pifer, J.E.; Croft, M.C. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Physics). Jun 1985. Contract AS05-82ER12061. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016971.

Research reported includes development of a high pressure electron resonance apparatus and a resistivity apparatus, and studies of valence instabilities in crystalline and amorphous materials.

45744 **(DOE/ER/45135—13) Electronic properties of two-dimensional systems in sub-micron devices. Progress report, July 1, 1984-August 31, 1985.** O'Connell, R.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1985. Contract FG05-84ER45135. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016840.

First, we describe our magneto-optical studies (with emphasis on Faraday rotation) of two-dimensional systems. Secondly, we describe work on the Wigner distribution function, which has been concerned both with the fundamentals and with applications to specific problems in two-dimensional systems. Thirdly, a paper in "Nature" with D.F. Walls (from New Zealand) deals with the role of two-particle Wigner distribution functions in measurement processes, our next goal being to include the effects of a heat-bath, a subject of much interest in various facets of condensed-matter research. Fourthly, much time over the last year was spent on exploratory work which deals with the application of the Wigner distribution formalism to the topical problem of the melting of a two-dimensional crystal lattice. Finally, the author decided to look into the merits of carrying out research on magnetic biexcitons. This involved resurrecting old computer programs used for calculations of the hydrogen spectrum in a strong magnetic field.

45745 **(LA-UR—85-2504) Deconvolution analysis to determine relaxation time spectra of internal friction peaks.** Cost, J.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-8506125—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015702.

From Conference on internal friction and ultrasonic attenuation in solids; Urbana, IL, USA (3 Jun 1985).

A new method for analysis of an internal friction vs temperature peak to obtain an approximation of the spectrum of relaxation time responsible for the peak is described. This method, referred to as direct spectrum analysis (DSA), is shown to provide an accurate estimate of the distribution of relaxation times. The method is validated for various spectra, and it is shown that: (1) It provides approximations to known input spectra which replicate the position, amplitude, width and shape with good accuracy (typically 10%). (2) It does not yield approximations which have false spectral peaks.

45746 **(UCRL—91697) Analysis of dislocation kinetics across shocks.** Stout, R.B. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 22p. (CONF-850770—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016444.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

The classical continuum analysis for possible propagating spatial discontinuties of mass density, velocity, stress, and energy across a shock front does not explicity consider the possibility of a discontinuity in the dislocation density function. One reason for not previously considering this possibility is that the dislocation density function does not appear explicity in the mathematical representation for deformation in a continuum approach. For purposes of a more physically realistic model, a discontinuum formulation that does represent interatomic discontinuities and does have an explicit dislocation density dependent deformation and thermodynamics has been developed. Based on this formulation, a discontinuum analysis for a discontinuity in the dislocation density function, as well as the mass density, velocity, stress and energy across a shock is described. In the limit of no dislocation kinetics, the discontinuum shock conditions reduce to the continuum shock conditions. A non-equilibrium thermodynamics is formulated that partitions the work rate at the shock front into different energetic components of internal energy. By applying Onsager's methods, a relationship is derived for the propagation velocity of the shock front in terms of the train discontinuity and dislocation kinetics across the shock front. Because of recent experiments that studied the change in dislocation density resulting from strong shocks, it is believed that these discontinuum shock conditions will be useful to interpret, analyze, and design experiments.

45747 **Influence of surfaces on vapor pressures.** Searcy, A.W. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **83**: No. 6, 3095-3098(15 Sep 1985).

An analysis of internal particle equilibrium in J. Chem. Phys. 81, 2489 (1984) is generalized by means of Lagrange's method of undetermined multipliers to show that a one-component crystalline particle of fixed size and shape is at equilibrium at constant temperature and pressure when the chemical potentials of molecular species, μ/sub i/, μ/sub j/, ..., and of vacancies μ/sub v/i, μ/sub v/j, ..., for sites i, j,... of different characteristic bond environments fit the relation μ/sub i/-μ/sub v/i = μ/sub j/-μ/sub v/j = xxx . The chemical potential differences between molecular species and vacancies is shown to be the chemical potential for the component. The influence of surfaces on vapor pressures is predicted by setting the chemical potential of the component in the particle equal to that of its vapor. The predicted effects of surfaces are larger than those of classical theory but are in reasonable agreement with measurements for liquid drops.

45748 **Numerical simulation of quantum spin models.** Kung, D.; Blankenbecler, R.; Sugar, R.L. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] B: Condensed Matter;* **32**: No. 5, 3058-3066(1 Sep 1985). Contract AC03-76SF00515;AT03-83ER45008.

The general application of the projector Monte Carlo method to spin systems is discussed. The purpose of the paper is to present several variants of the method that improve its accuracy and convergence in specific problems and to give numerical examples of the improvements. More detailed application to specific spin models is left for subsequent publications.

45749 Critical dynamics, Lifshitz tricriticality, and supersymmetry: The Ising model on the hcp lattice. Domany, E.; Gubernatis, J.E. (Department of Electronics, The Weizmann Institute of Science, Rehovot 76100, Israel). *Physical Review [Section] B: Condensed Matter;* **32**: No. 5, 3354-3357(1 Sep 1985).

Critical dynamics in d dimensions can be mapped onto a supersymmetric equilibrium problem in d+1 with a Lifshitz tricritical point. The existence of such a point is demonstrated for the Ising model on the hcp lattice by Monte Carlo simulation.

45750 Role of relaxation in epitaxial growth: A molecular-dynamics study. Schneider, M.; Rahman, A.; Schuller, I.K. (Materials Science and Technology Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **55**: No. 6, 604-606(5 Aug 1985).

The epitaxial growth of a Lennard-Jones system is studied as a function of substrate temperature T/sub s/ and deposition rate. For all substrate temperatures the growth is into well-ordered layers. Layers become fully completed at intermediate T/sub s/. At very low T/sub s/ the layers contain defects and voids; however, the atoms are still arranged in close-packed islands within the layers.

6561 Superconductivity

REFER ALSO TO CITATION(S) 44645, 45389, 45392

45751 p-wave superconductivity in heavy-fermion systems: An induced-interaction approach. Bedell, K.S.; Quader, K.F. (Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review [Section] B: Condensed Matter;* **32**: No. 5, 3296-3299(1 Sep 1985). Contract AC02-76ER13001.

The Fermi-liquid parameters for heavy-fermion systems are calculated. The spin fluctuations (F_0/sup a/) renormalize the effective mass modestly, but significantly affect the triplet scattering amplitude; consequently, p-wave pairing occurs. Additionally in the extreme limit of this model, F_0/sup a/$\rightarrow -0.906$ while the effective mass diverges algebraically, suggesting a Mott-like localization. This is a consequence of the finite range of the effective interactions and many-body correlations.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 45541, 45568, 45772

45752 (BONN-HE—85-2) W-matrix: A new method for solving the two-body problem. Bartnik, E.A.; Haberzettl, H.; Sandhas, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1985. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752086.

We present a new momentum space approach to the two-body problem in partial waves. The method allows one to solve both the bound state and the scattering problems in terms of one single inhomogeneous integral equation and thus unifies the descriptions of both energy regimes. This integral equation is real and manifestly non-singular also at scattering energies; for uncoupled partial waves it can even be solved by iteration under only very global constraints on the potential, regardless of the potential strength. Moreover, its solution (called W-matrix) leads to a very simple and practical integral representation of the Jost function in terms of momentum space quantities only. We demonstrate the applicability of our method by calculating bound state and scattering data for the two-nucleon system with the s-wave Malfliet-Tjon III and the $^3S_1$-$^3D_1$ Reid soft-core potentials. We find that both the bound state and the scattering problems can be solved reliably with equal ease by our method.

45753 (CNRS-CPT—84-P-1663) Non-Abelian Bohm-Aharonov effect in geometric quantization. Horvathy, P.A.; Kollar, J. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752069.

The non-Abelian Bohm-Aharonov experiment proposed by Wu and Yang is studied in the geometric framework of Kostant and Souriau.

45754 (IC—84/147) Ground state energy of two-dimensional electrons in strong magnetic fields: small clusters in fractional occupation. Lai, Wuyan; Yu, Lu; Su, Zhaobin; Yu, Kun. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701923.

We diagonalize numerically the Hamiltonian for a two-dimensional system of up to seven electrons interacting via Coulomb force in a strong magnetic field using the symmetric gauge. The effect of positive charge background is taken into account. We find significant downward cusps for certain values of the total angular momentum corresponding to fractional occupation of the lowest Landau level in agreement with the results obtained by using the Landau gauge. This commensurate energy for fractional occupation is interpreted in terms of the "closest configuration" in the space of single particle angular momentum.

45755 (INIS-mf—9489, pp 283-297) Large N expansions work. Mlodinow, L.D. (California Inst. of Tech., Pasadena (USA)). 1981. NTIS (US Sales Only), PC A22/MF A01. File Number DE85781516. (CONF-8105114—).

From 4. Warsaw symposium on elementary particle physics; Kazimierz, Poland (1 May 1981).

The so-called large N expansions for a wide variety of quantum mechanical problems are analyzed and the application of such expansions is described. (I.L.).

45756 (IPNO-TH—84-39) Relativistic quantum mechanics of two interacting spinless particles. Rizov, V.A.; Sazdjian, H.; Todorov, I.T. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). May 1984. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85751192.

The L_2-scalar product $\int PHI^*(x)PSI(x)\,d^3x$ is not appropriate for the space of states describing the center-of-mass relative motion of two relativistic particles whose interaction is given by an energy dependent quasipotential. The problem already appears in the relativistic quantum mechanics of a Klein-Gordon charged particle in an external field. We extend the methods developed for that case to study a two-particle system with an energy independent scalar interaction as well as the relativistic Coulomb problem. We write down a Poincare invariant inner product for which the eigenfunctions corresponding to different energy eigenvalues are orthogonal. We also construct a perturbative expansion for bound-state energy eigenvalues corresponding to an arbitrary energy dependent (quasipotential) correction to an unperturbed Hamiltonian with a known spectrum. The description of observables and transition probabilities for eigenvalue problems with a polynomial dependence on the spectral parameter is also discussed.

45757 (LAPP-TH—108) Missing energy sources at large Psub(T) from standard QCD processes. Aurenche, P.; Kinnunen, R. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). May 1984. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751147.

A detailed analysis is given of processes involving the production of heavy vector bosons as sources of events with a single hadronic jet balanced by a large missing energy or possibly a charged large Psub(T) lepton and missing energy. In particular, the hadronic channels of the tau lepton produced in W^{+-} decays provide an appreciable rate of monojet events, with energetic narrow jets of low charged multiplicity. Furthermore it is shown that higher order QCD corrections to weak boson production, in particular the Compton like process $qg \rightarrow Zq$ or $qg \rightarrow Wq$ are an appreciable source of the types of events mentionned above.

45758 (LAPP-TH—113) Antisymmetric tensor gauge potential in curved superspace and a 16 + 16 supergravity multiplet. Girardi, G.; Grimm, R.; Mueller, M.; Wess, J. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jun 1984. 17p. (KA-THEP—84-6). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751146.

Superspace constraints which reduce the non minimal (20 + 20) supergravity multiplet to a (16 + 16) multiplet are obtained by specifying the superspace geometry of a two form gauge potential. The multiplet, its transformation laws and its invariant action are given. For n = - 1/2 this multiplet describes the truncation of a N=4 extended supergravity with antisymmetric gauge potential.

45759 (LAPP-TH—114) Spin (3/2,1) multiplet and superspace geometry. Gates, S.J.; Grimm, R. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jun 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751148.

We give a completely geometrical derivation of the de Wit-van Holten formulation of a supermultiplet with physical helicity states one and three-halves. We identify all of the components of the multiplet, derive the transformation laws, and construct an invariant action. Like supergravity the action is not expressible only in terms of field strengths.

45760 (LPC—84-24) Classical mechanics and confinement. Benayoun, M.; Leruste, P. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Oct 1984. 20p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752075.

The problem of N Particles interacting through rsup(α) potential is studied. For some range of values of α ($0 < \alpha < 2$) and a convenient choice of coupling between particles (generally a non-factorisable one), minimising the potential energy of the system leads to the clustering in particle - anti particle pairs and particle triplets. This could provide a classical view of the confinement phenomenon.

45761 (PB—85-190791/XAB) Quantum bound states where the classical motion is unbounded. Gunn, J.M.F. (Rutherford Appleton Lab., Chilton (UK)). [1985]. 17p. (RAL—84-104). NTIS, PC E03/MF E03.

An example of bound quantum states occurring where the classical motion is unbounded is given. It consists of a void in an otherwise perfect array of hard-sphere scattering centers. The Hamiltonian consists only of kinetic energy and an interpretation is that the particle is bound in order to lower its kinetic energy is given, contrary to usual intuition. The calculation is also an unusual solid-state physics problem. The physical situations where this may be relevant are mentioned.

45762 (SI—84-8) Asymptotic behavior of massless Feynman integrals in the limit of several large scales. Ohrndorf, T. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 -Naturwissenschaften 1 (Physik)). Jul 1984. 59p. Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen, Germany, F.R.

A general method is developed, which permits the calculation of the asymptotic behavior of Feynman integrals in the limit of several large scales. All those contributions, which are power law suppressed are neglected. The parametric representation of Feynman integrals is employed, which is reviewed concisely. Our main tool is the multiple Mellin transform of Feynman integrals with respect to their external momenta. A transformation of the Feynman parameters is represented, which allows the systematic isolation of the leading poles in the multiple Mellin plane.

45763 (UWThPh—84-44) Stochastic quantization and gravity. Rumpf, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701917.

We give a preliminary account of the application of stochastic quantization to the gravitational field. We start in Section I from Nelson's formulation of quantum mechanics as Newtonian stochastic mechanics and only then introduce the Parisi-Wu stochastic quantization scheme on which all the later discussion will be based. In Section II we present a generalization of the scheme that is applicable to fields in physical (i.e. Lorentzian) space-time and treat the free linearized gravitational field in this manner. The most remarkable result of this is the noncausal propagation of conformal gravitons. Moreover the concept of stochastic gauge-fixing is introduced and a complete discussion of all the covariant gauges is given. A special symmetry relating two classes of covariant gauges is exhibited. Finally Section III contains some preliminary remarks on full nonlinear gravity. In particular we argue that in contrast to gauge fields the stochastic gravitational field cannot be transformed to a Gaussian process.

45764 (UWThPh—84-46) Order of levels in potential models. Baumgartner, B.; Grosse, H.; Martin, A. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701915.

Various extensions of a previously derived theorem on the order of levels of quantum mechanical systems are discussed. Local conditions on the potential are given, such that the n-th level of angular momentum l lies above (or below) the (n-1)-th level with angular momentum $l+\alpha$. Some improved versions are formulated as conjectures and are shown to be true in certain limiting situations. As possible applications we discuss beside heavy quark systems the level order in atomic physics.

45765 (UWThPh—85-01) From relative entropy to entropy. Narnhofer, H.; Thirring, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701916.

We give an intrinsic definition of the entropy of a state over an algebra and show that it has the general properties of von Neumann's entropy.

45766 Optimal paths for thermodynamic systems: The ideal diesel cycle. Hoffman, K.H.; Watowich, S.J.; Berry, R.S. (Department of Chemistry and the James Franck Institute, The University of Chicago, Chicago, Illinois 60637). *Journal of Applied Physics;* **58**: No. 6, 2125-2134(15 Sep 1985).

Optimal control theory is used to determine the piston trajectory which yields maximum power output for a model which incorporates the diesel engine's major irreversibilities. Optimal trajectories were obtained for the cases of unconstrained and constrained piston acceleration. Optimizing the path for our standard engine increased both the net work output per cycle and the net efficiency by about 10%.

45767 Parametric scaling of the stability of relativistic laminar flow magnetic insulation. Antonsen T.M. Jr.; Ott, E.; Chang, C.L.; Drobot, A.T. (Science Applications International Corporation, 1710 Goodridge Drive, McLean, Virginia 22102). *Physics of Fluids;* **28**: No. 9, 2878-2881(Sep 1985).

The short wavelength limit of the magnetron instability of a relativistic sharp boundary electron sheath is examined. For short wavelengths the mode is localized to the sheath edge. This localization leads to a simple relationship (essentially a Lorentz transformation) between the relativistic and nonrelativistic growth rates. This relationship involves only equilibrium quantities evaluated at the sheath edge and explains previously noted trends that have been observed numerically.

45768 Backward wave oscillators with rippled wall resonators: Analytic theory and numerical simulation. Swegle, J.A.; Poukey, J.W.; Leifeste, G.T. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physics of Fluids;* **28**: No. 9, 2882-2894(Sep 1985). Contract AC04-76DP00789.

In this paper, a comprehensive theoretical treatment is developed for backward wave oscillators composed of a relativistic electron beam guided by a strong magnetic field through a slow wave structure consisting of a cylindrical waveguide with a sinusoidally varying wall radius. This analysis, equally applicable to traveling wave tube operation, includes both a linearized theory of small-amplitude perturbations and numerical simulations of the saturated, large-amplitude operating regime. The variation of device operating characteristics with system parameters is examined in detail. Comparisons of the analytic and numerical results with experiments and additional calculations show excellent agreement and justify a high degree of confidence in the validity of the theory.

45769 **Fat fractals on the energy surface.** Umberger, D.K.; Farmer, J.D. (Center for Nonlinear Studies, MS B258, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **55**: No. 7, 661-664(12 Aug 1985).

For a closed system of two coupled nonlinear oscillators, chaotic orbits are punctuated by holes associated with stable periodic orbits. For the corresponding class of Hamiltonian maps we demonstrate that the combined area for all holes of size ϵ or greater scales as a power law with exponent β and asymptotic area $0 < \mu < 1$. In contrast to previous results, this is a global scaling property, valid for a set of positive Lebesgue measure. It suggests that these chaotic orbits are fat fractals, i.e., Cantor setlike objects of positive area. We numerically compute lower bounds on their area.

45770 **Generalized supersymmetric quantum mechanics.** Sathiapalan, B. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review Letters;* **55**: No. 7, 669-672(12 Aug 1985). Contract AC02-76ER03071.

The spectrum of a supersymmetric quantum mechanical theory that leads to a generalized superalgebra is computed exactly. It has the feature that both the ground and first excited levels have unequal numbers of Bose and Fermi states.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 44957

45771 **(IC—84/148) Special function on nonselfdual cones.** Yin, Weiping. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85701912.

Expressions for a nonselfdual cone Vsub(II) and its dual cone Vsub(II)* are given. The Gamma function on Vsub(II) is defined, and the Siegel integral associated with Vsub(II) is written down. The Gamma function and Siegel integral on Vsub(II)* are also exhibited. From these, Cauchy-Szego kernels and formal Poisson kernels of Siegel domains of first type associated with Vsub(II) and Vsub(II)* are obtained.

45772 **(JINR—R-2-84-250) N=4 supersymmetric Liouville equation.** Ivanov, E.A.; Krivonos, S.O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 8p. (In Russian). (CONF-840757—35). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701913.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

Submitted to the journal J. Phys., A Math. Gen.: Letter to Editor.

A superfield N=4 superextension of the Liouville equation with gauge SU(2) x SU(2) symmetry is constructed. It is formulated in terms of real quaternionic N=4 superfield subjected to certain Grassmann analyticity constraints and possesses a zero-curvature representation of superalgebra su(1, 1/2). A possible relevance of the obtained system to SU(2)-superstring is discussed.

45773 **(LAPP-TH—103) Representations of OSp(M/n) and Young supertableaux.** Morel, B.; Sciarrino, A.; Sorba, P. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Apr 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85751193.

Young supertableaux are introduced for finite dimensional representations of orthosymplectic superalgebras and used to study their content.

45774 **(PPPL-TRANS—133) Statistics of Poincare recurrences and the structure of the stochastic layer of a nonlinear resonance.** Chirikov, B.V.; Shepelyansky, D.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.; AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Feb 1983. Contract AC02-76CH03073. Translation of Preprint INP 81-69. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017025.

Motion in the stochastic layer around the separatrix of a nonlinear resonance was investigated. The integral distribution function F(tau) of trajectory recurrence times tau to the center of the layer was numerically determined. It was found that the distribution F(tau) = A tau^{-}/sup p/ is a power function, the exponent assuming two different values: for tau $\leqq$ tau$_0$, p = 1/2 and for tau >> tau$_0$, p = 3/2 (time tau$_0$ is determined by the characteristics of the layer).

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 45322

45775 **(Rijnhuizen-ASR—1983) Annual status report, 31 December 1983. [Research in Plasma Physics].** (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Apr 1984. 105p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85701924.

Lists of publications, contributions to conferences.

The research work of the Institute for Plasma Physics at Rijnhuizen during 1983 is surveyed. The Experimental Division reports on: pinches; turbulent heating in TORTUR, a small tokamak; numerical calculations on cold plasma blankets; electron cyclotron resonance heating; and, diagnostic subsystems. The Theoretical Division reports on: magnetohydrodynamics, wave dynamics and transport problems. Finally, the Department of Technology and Engineering reports on subjects as: high-power engineering, electronic control and computer hardware and software.

45776 **Fusion Energy Update: a current awareness journal.** Whitson, M.O. (ed.). *Fusion Energy Update;* No. 85/1, vp(Jan 1985). (PB—85-915301; CFU—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $75.00 per volume (calendar) year.

Fusion Energy Update (CFU) provides monthly abstracting and indexing coverage of current scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs for all sources on fusion energy. All information announced in CFU, plus additional backup information, is included in the energy information data base of the Department of Energy's Office of Scientific and Technical Information. The subject matter covered by CFU includes plasma physics, the physics and engineering of blankets, magnet coils and fields, power supplies and circuitry, cooling systems, fuel systems, radiation hazards, power conversion systems, inertial confinement systems, and component development and testing. These subjects are arranged by categories as shown in the table of contents.

7001 Plasma Research

REFER ALSO TO CITATION(S) 45042, 45878

45777 **(AD-A—153980/8/XAB) Millimeter-wave generation by relativistic electron beams. Annual report, 1 October 1983-30 September 1984.** Kuo, S.P.; Cheo, B.R. (Polytechnic Inst. of New York, Farmingdale (USA). Dept. of Electrical Engineering). 1 Dec 1984. 131p. NTIS, PC A07/MF A01.

We are studying various wave-plasma interaction processes towards the understanding of the collective physics of plasmas. The processes include the mechanisms leading to the generation of millimeter waves by relativistic electron beams (electron cyclotron maser instability) and the mechanisms providing channels for anomalous absorption of electromagnetic waves (electron cyclotron resonance heating and parametric instabilities). A single nonlinear equation that describes the temporal evolution of the field amplitude of the electron-cyclotron maser instability was derived self-consistently. Three adiabatic invariants are derived of the electron motion under the electon cyclotron resonance heating by three differently polarized heaters: (1) ordinary mode; (2) extraordinary mode; and (3) electrostatic mode. Wave-plasma interaction leading to various parametric instabilities in the ionosphere was also studied.

45778 **(AD-A—154902/1/XAB) Low-frequency instabilities driven by an ion-temperature anisotropy. Memorandum report, October 1984-October 1985.** Lee, Y.C.; Huba, J.D. (Naval Research Lab., Washington, DC (USA)). 8 May 1985. 42p. (NRL-MR—5552). NTIS, PC A03/MF A01.

A detailed linear analysis is presented of low-frequency instabilities driven by an ion-temperature anisotropy. In particular, the electromagnetic ion-cyclotron instability, the mirror instability, and the firehose instability are investigated. These instabilities require a high-beta plasma, which is typical of an early-time HANE plasma. The electromagnetic ion-cyclotron and mirror instabilities also require ion-temperature anisotrophy, while the firehose instability requires ion-temperature anisotrophy. In general, the early-time-coupling shell is expected to have ion-temperature anisotropy so that the firehose instability is not obviously relevant to HANE situations but is included for the sake of completness. An analysis of the influence of an electron temperature is also included for the sake of completeness. Also included is an analysis of the influence of an electron temperature anisotropy on the magnetohydrodynamics instability. This is an extension and correction of the work of Basu and Coppi (1984). Application of this research to HANE phenomena is discussed.

45779 **(DOE/ET/53088—172) Compressibility effects on ideal and kinetic ballooning modes and elimination of finite Larmor radius stabilization.** Kotschenreuther, M. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1985. Contract FG05-80ET53088. 69p. (IFSR—172). NTIS, PC A04/MF A01; GPO Dep. File Number DE85017162.

The dynamics of ideal and kinetic ballooning modes are considered analytically including parallel ion dynamics, but without electron dissipation. For ideal modes, parallel dynamics predominantly determine the growth rate when β is within ~30% of the ideal threshold, resulting in a substantial reduction in growth rate. Compressibility also eliminates the stabilization effects of finite Larmor radius (FLR); FLR effects (when temperature gradients are neglected) can even increase the growth rate above the MHD value. Temperature gradients accentuate this by adding a new source of free energy independent of the MHD drive, in this region of ballooning coordinate corresponding in MHD to the continuum. Analytic dispersion relations are derived demonstrating the effects above; the formalism emphasizes the similarities between the ideal MHD and kinetic cases.

45780 **(INIS-mf—9746) Linear and nonlinear wave propagation and mode conversion in an inhomogeneous, unmagnetized plasma with a resonance.** Kamp, L.P.J. (Technische Hogeschool Eindhoven (Netherlands)). 8 May 1984. 278p. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781542.

Includes Dutch summary; 197 refs.; 23 figs.

In this thesis some aspects of linear and nonlinear wave propagation and wave conversion in an inhomogeneous, unmagnetized, lossless plasma with a resonance are elucidated. After the general introduction an infinitely long, cylindrical antenna immersed in an inhomogeneous, cold plasma with a resonance is studied. In order to understand better the singular behaviour of the radiated electromagnetic field and its absorption in the resonance layer, a more realistic plasma is considered. A theory is developed of linear mode conversion in a planarly stratified, warm plasma with a resonance that is based on a two-fluid model for the plasma. These results are rediscovered in the limit of low temperatures by means of a kinetic approach to the problem of linear mode conversion. Finally the modification is described of the electron-density profile by a force of nonlinear origin. A new type of modulational instability is analyzed and the propagation of solitons and cavitons in the resonance region is studied.

45781 **(INIS-mf—9747) Investigation of pulsed high density plasmas.** Timmermans, C.J. (Technische Hogeschool Eindhoven (Netherlands)). 25 May 1984. 164p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781540.

Includes Dutch summary; 164 refs.; 86 refs.; 2 tabs.

In this thesis a wall-stabilized argon cascade arc is studied at values of pulsed pressure up to 14 bar and a pulsed current range up to 2200 A with a time duration of about 2 ms. The basic plasma is a CW cascade arc with a 5 mm diameter plasma column and a length of 90 mm, which operates at a 60 A DC current and at one atmosphere filling pressure. The author starts with an extensive summary of the CW arc investigations. After a brief introduction of the basic transport equations the mass equations of the constituent particles are treated using the extended collisional radiative model. The energy balance equations and the momentum balance are discussed. The electron density is determined from measurements of the continuum radiation. The final chapter contains the experimental results on the electron temperatures and electron densities in the pressure and current pulsed plasma. Attention is given to the deviations from local thermodynamic equilibrium values of the ground level densities of the different argon systems.

45782 **(INIS-mf—9754) Kinetic theory of the one-component plasma.** Cohen, J.S. (Amsterdam Univ. (Netherlands)). 19 Dec 1984. 116p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781541.

Includes Dutch summary; 58 refs.; 4 figs.; 8 tables.

In this thesis, kinetic theory is applied to transport phenomena of a one-component plasma. Existing kinetic equations, containing both dynamical screening effects and close binary collisions do not suffer from divergencies. Recently an approximation for the pair correlation function has been proposed that is valid for small values of the plasma collision parameter. Upon insertion of this expression into the general form of the collision integral, one obtains another convergent kinetic equation. This thesis shows that both kinetic equations yield the same coefficient of heat conductivity and viscosity; and that for a hot dilute plasma the arbitrary transport coefficient is rather insensitive to the pair correlation function. In the second part, the author studies the diffusion of a tagged particle in an external magnetic field. It is found that the longitudinal self-diffusion coefficient contra-varies monotonically with the magnetic field strength.

45783 **(INIS-mf—9755) Curvature-induced electrostatic drift modes in a toroidal plasma.** Venema, M. (Rijksuniversiteit Utrecht (Netherlands)). 9 Jan 1985. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85781543.

Includes Dutch summary; 51 refs.; 38 figs.

This thesis deals with a number of problems in the theory of linear stability of a hot, fully ionized plasma immersed in a strong magnetic field. The most widely used system to magnetically confine a plasma is the tokamak. This is a toroidal, current carrying device with a strong, externally imposed, magnetic field. The author discusses the linear theory of unstable, low-frequency waves in the gradient region, restricted to electrostatic waves. In that case the resulting radial fluxes of particles and energy are due to electric cross-field drifts. In the presence of magnetic fluctuations and small-scale reconnection phenomena, radial transport could also be predominantly along field lines. At present, it is not clear which of the two mechanisms is the dominant feature of the observed anomalous transport. First, the author introduces the theory of drift waves in toroidal geometry. Next, the electrostratic drift modes in toroidal geometry (weakly collisional regime), the equations for low-frequency waves in the strongly collisional regime and the electrostatic drift modes (strongly collisional regime) are discussed.

45784 **(UCRL—91640) Elimination of electromagnetic radiation in plasma simulation: the Darwin or magnetoinductive approximation.** Hewett, D.W. (Lawrence Livermore National Lab., CA (USA)). 21 Feb 1985. Contract W-7405-ENG-48. 16p. (CONF-850266—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016074.

From 2. international school for space simulation; Honolulu, HI, USA (3 Feb 1985).

For many astrophysical and most magnetic fusion applications, the purely electromagnetic modes generated by real as well as simulation "plasma" fluctuations are a source of high frequency radiation that is often irrelevant to the physics of interest. Unfortunately, a numerical CFL stability limit prevents either making c infinite or deltat large while using the usual explicit Maxwell's equations for the fields. A modification of Maxwell's equations, which provides implicitly the field components, circumvents this problem. The solution is to neglect retardation effects so that the electromagnetic propagation speed is effectively infinite. The purely electro-

magnetic modes in this limit evolve "instantly" to a time-asymptotic configuration about the macroscopic plasma configuration at each new time level. The Darwin or magnetoinductive approximation effectively provides infinite propagation speeds for purely electromagnetic modes by converting Maxwell's equations from hyperbolic to elliptic in character. In practice, this is accomplished by neglecting the solenoidal part of the displacement current. The elimination of the CFL time step constraint more than offsets the substantially more complicated field solution that is required. The details of a numerical implementation of this model will be presented. Numerical examples will be given and extentions of the Darwin field solution to other plasma models also will be considered. 9 refs., 3 figs.

45785 **(UCRL—92689) Acceleration of compact torus plasma rings in a coaxial rail-gun.** Hartman, C.W.; Hammer, J.H.; Eddleman, J. (Lawrence Livermore National Lab., CA (USA)). 16 May 1985. Contract W-7405-ENG-48. 5p. (CONF-8505100—18). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016069.

From 7. US symposium on compact toroid research; Santa Fe, NM, USA (21 May 1985).

We discuss here theoretical studies of magnetic acceleration of Compact Torus plasma rings in a coaxial, rail-gun accelerator. The rings are formed using a magnetized coaxial plasma gun and are accelerated by injection of B/sub θ/ flux from an accelerator bank. After acceleration, the rings enter a focusing cone where the ring is decelerated and reduced in radius. As the ring radius decreases, the ring magnetic energy increases until it equals the entering kinetic energy and the ring stagnates. Scaling laws and numerical calculations of acceleration using a O-D numerical code are presented. 2-D, MHD simulations are shown which demonstrate ring formation, acceleration, and focusing. Finally, 3-D calculations are discussed which determine the ideal MHD stability of the accelerated ring.

45786 **Radio frequency heating in the ion-cyclotron range of frequencies.** Swanson, D.G. (Department of Physics, Auburn University, Auburn, Alabama 36849). *Physics of Fluids;* **28**: No. 9, 2645-2677(Sep 1985). Contract AS05-82ER53134.

Both the theory of the absorption process in the ion-cyclotron range of frequencies and some of the experiments which slow the promise and problems with radio frequency plasma heating in this range are discussed. It is shown that mode conversion is invariably involved in the process and so an extensive review of mode conversion theory, expecially as it applies to problems with back-to-back cutoff-resonance pairs, is included. This includes a discussion of the tunneling equation with and without absorption effects and with and without energy conservation. The general theory is applied to various ion-cyclotron harmonics, the two-ion hybrid resonance, and to a case where a wave converts to a Bernstein mode at the plasma edge. The results are given analytically for a variety of cases without absorption, and empirical formulas are given for the second and third harmonics of the ion-cyclotron frequency, which include effects of absorption. Various problem areas in the theory are also discussed with some of the limitations caused by the approximations involved. A number of experiments are also discussed which show effective heating, and some show the features of the mode conversion process, indicating that the general processes of absorption are reasonably well understood. Areas where further work is necessary, both in fundamental theory and in comparing theory with experiment, are also discussed.

45787 **Electron confinement in a bumpy torus without the influence of hot-electron rings: "Ring killer" experiment.** Hillis, D.L.; Wilgen, J.B.; Cobble, J.A.; Davis, W.A.; Hiroe, S.; Rasmussen, D.A.; Richards, R.K.; Uckan, T.; Jaeger, E.F.; Hankins, O.E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **28**: No. 9, 2848-2856(Sep 1985). Contract AC05-84OR21400.

The ELMO Bumpy Torus (EBT) [Plasma Physics and Controlled Nuclear Fusion (IAEA, Vienna, 1975), Vol. II, p. 141] normally has an energetic electron ring in each of its 24 mirror sectors. The original intention of using this hot-electron population was to provide an average local minimum in the magnetic field (through its diamagnetism) to stabilize the simple interchange and flute modes, which otherwise are theoretically inherent in a closed-field-line bumpy torus. To study the confinement properties of a bumpy torus without the influence of hot-electron rings, a water-cooled stainless steel limiter in each mirror sector was extended into the plasma to the ring location; this eliminated the hot-electron ring population. These limiters were aptly named "ring killers." Electron temperature, density, space potential, and plasma fluctuations have been measured during the ring killer experiment and are compared to standard EBT operation. The results of these experiments indicate that the hot-electron rings in EBT do enhance the core plasma properties of EBT and do, in fact, reduce plasma fluctuations; however, these improvements are not large in magnitude. These measurements and recent theoretical models suggest that simple interchange/flute modes are stabilized, or fluctuation levels reduced, well before that condition is obtained for average minimum-B stabilization.

45788 **Viscous effects in a collisional tokamak plasma with strong rotation.** Stacey W.M. Jr.; Sigmar, D.J. (Georgia Institute of Technology, Atlanta, Georgia 30332). *Physics of Fluids;* **28**: No. 9, 2800-2807(Sep 1985).

The full viscosity tensor for an axisymmetric toroidal plasma in the collisional regime (with strong rotation) is calculated, including gyroviscosity and O(ϵ) poloidal variations over the flux surface. It is shown that the resulting viscous force is of sufficient magnitude to account for the radial transfer of toroidal momentum that must be inferred in order to explain the rotation measurements in tokamak experiments. The consequences of a viscous force of this form and magnitude on particle transport and on the evolution of toroidal and poloidal rotation velocities are discussed.

45789 **Simulations of the single-mode, bump-on-tail instability.** Denavit, J. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **28**: No. 9, 2773-2777(Sep 1985).

The nonlinear saturation of the single-mode, bump-on-tail instability is studied by numerical solutions of the Vlasov equation. Modes close to marginal stability are found to saturate with a field amplitude EproportionalΔ^{3}, where the small parameter $\Delta = 2(\omega-\omega')/\omega'$ defines the difference between the mode frequency ω and the frequency ω' of the marginally stable mode. This scaling agrees with O'Neil's theory [Phys. Fluids 14, 1204 (1971)] of the two-stream instability, and does not confirm the time asymptotic analysis of Simon and Rosenbluth [Phys. Fluids 19, 1567 (1976)], which predicts larger amplitudes with EproportionalΔ^{1}/sup //^{3}.

45790 **Ponderomotive and sideband coupling effects of ion-cyclotron heating on interchange stability.** Cohen, B.I.; Rognlien, T.D. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **28**: No. 9, 2793-2799(Sep 1985). Contract W-7405-ENG-48.

Two-fluid theory is used to calculate the nonlinear effect of a finite-amplitude ion-cyclotron wave on the simple interchange stability of a magnetically confined plasma. The ion-cyclotron wave nonlinearly modifies interchange stability through ponderomotive effects and coupling to sidebands of the ion-cyclotron wave. Nonlinear stability criteria for flute modes are derived. The nonuniformity and polarization of the ion-cyclotron wave significantly influence the results. A theoretical explanation for recent experimental observations in axisymmetric mirror and tandem mirror plasmas of reduced levels of magnetohydrodynamic activity in the presence of ion-cyclotron resonant heating remains elusive.

45791 **Ballooning stability boundaries with plasma compression.** Cooper, W.A.; Sigmar, D.J.; Hirshman, S.P. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **28**: No. 9, 2813-2815(Sep 1985). Contract AC05-84OR21400.

Level curves for the resistive compressible ballooning growth rates and the ideal ballooning stability boundaries with incompressibility and perpendicular compressibility are determined in the parameter space of shear-versus-pressure gradient for realistic

tokamak equilibria. The trajectories of these level curves differ from the ideal incompressible stability boundary in this space.

45792 **Quasilinear saturation of the kinetic ion mixing mode.** Migliuolo, S. (Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **28**: No. 9, 2778-2785(Sep 1985). Contract AC02-78ET51013.

The linear and quasilinear theories of the ion mixing mode are discussed in the electrostatic limit. The source of free energy for the instability is the ion temperature gradient. The parameter relevant to this calculation is eta/sub i/ = (d ln T/sub i//dr)/(d ln n/dr). Generally, this mode has a phase velocity comparable to the ion thermal velocity and there exist values of eta/sub i/ that yield maximum growth. By using a time-asymptotic formalism, we are able to discuss the quasilinear saturation of this mode. Short wavelength modes saturate at small amplitudes, 'ephi$_i$/T/sub i/'^{2} < or =(eta/sub i/-eta/sub c/)/eta/sub c/, where eta/sub c/ is the value of eta/sub i/ at marginal stability, and the saturated state is stable against further perturbations. Long wavelength modes also saturate, though the saturation is of the "hard" type: the saturated state itself is unstable. When saturation occurs, it is caused by reduced inverse ion Landau damping brought about both by the nonlinear frequency shift and by quasilinear modifications to the ion distribution function.

45793 **Analytical mode conversion calculations for the full wave equations at the ion second harmonics.** Chiu, S.C. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **28**: No. 9, 2808-2812(Sep 1985). Contract AC03-84ER53158.

The wave equations for the second harmonic ion-cyclotron heating as derived from the Maxwell equations, rather than the model fourth-order equation, are solved analytically. With a better treatment of the wave field near the second harmonic resonance layer, the WKBJ solution can be improved to give results valid over a larger range of tunneling parameters than those derived in a previous work on a similar subject [J. Plasma Phys. 27, 327 (1982)]. Dissipation is also discussed and connection with the Budden model is shown.

45794 **Dissipative trapped particle modes in tandem mirrors.** Berk, H.L.; Rosenbluth, M.N.; Cohen, R.H.; Nevins, W.M. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids;* **28**: No. 9, 2824-2837(Sep 1985).

Dissipative trapped particle modes are studied in tandem mirrors by including electron collisions and ion Landau damping. A variational approach is used to obtain a collisional response in terms of the collisionless result plus a collisional term. The collisional term is then self-consistently solved in all collision frequency regimes. When $\nu/\omega << 1$ (vequivalentelectron collision frequency) and the dissipationless mode is stable through a positive (negative) charge uncovering mechanism, there are two stable waves with phase velocities in the ion (electron) diamagnetic direction. The higher frequency wave with $\omega \sim \omega$(/sub i/(ω(/sub e/) is destabilized by ion (electron) dissipation while the lower frequency wave is destabilized by electron (ion) dissipation. At high collision frequency ($\nu > \omega$(/sub e/), the only unstable trapped particle wave has $\omega \sim \omega$(/sub e/, with electron collisions being destabilizing.

45795 **Observation of the backward electrostatic ion-cyclotron wave.** Goree, J.; Ono, M.; Wong, K.L. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **28**: No. 9, 2845-2847(Sep 1985). Contract AC02-76CH03073.

The backward branch of the electrostatic ion-cyclotron wave has been observed for the first time. The wave, which was driven by a phased antenna structure inserted in a neon plasma, exists in the parameter ranges 2T/sub i//m/sub i/ << (ω/k/sub parallel/)^2 << 2T/sub e//m/sub e/, nΩ/sub i/ < ω < (n+1)Ω/sub i/, T/sub e/ > or ≃T/sub i/, and ω/sub p/i > Ω/sub i/. Double-tip probe interferometry data agree with the theoretical dispersion relation. The antenna couples into the wave more readily on the side of the antenna where it has its smallest wavenumber.

45796 **Emission of light at half-integer harmonics of the laser frequency.** Berger, R.L.; Powers, L.V. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). *Physics of Fluids;* **28**: No. 9, 2895-2909(Sep 1985). Contract AC08-82DP40152.

Calculations have been made of the spectrum of light emitted at half-integer harmonics of the laser light frequency ω_0. The emitted light results from either the Raman scattering of laser light by Langmuir waves or by the direct conversion of Langmuir waves to light. The Langmuir wave amplitude is calculated from convective instability theory for two-plasmon decay in an inhomogeneous, plane-stratified medium. The Raman scattering process generates harmonics at (n/2) ω_0 where n = 1,3,5 ...; however, only for n = 1 and 3 is the emission level significant. The conversion process produces (1/2) ω_0 light with a comparable efficiency to the Raman scattering process near the two-plasmon instability threshold. Results of the calculation are in agreement with the general features of measured emission spectra.

45797 **Brillouin scattering, two-plasmon decay, and self-focusing in underdense ultraviolet laser-produced plasmas.** Tanaka, K.; Boswell, B.; Craxton, R.S.; Goldman, L.M.; Guglielmi, F.; Seka, W.; Short, R.W.; Soures, J.M. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299). *Physics of Fluids;* **28**: No. 9, 2910-2914(Sep 1985). Contract FC08-85DP40200.

Underdense foam targets were irradiated with a single UV laser beam at intensities up to 10^{15} W/cm^2. The incident laser propagated into the foam a distance of 500—1000 μm, depending on the average target density. The backscattered Brillouin and $3\omega_0/2$ radiation were observed to have the same dependence on the incident laser intensity, indicating a strong interrelation of these processes. A possible coupling mechanism is proposed.

45798 **Nonlocal energy deposition in high-intensity laser-plasma interactions.** Wallace, J.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **55**: No. 7, 707-710(12 Aug 1985).

Electrons heated by the absorption of laser energy on planar targets generate megagauss magnetic fields which, together with the coproduced electric fields, transport the electrons away from the laser spot. We present a computational model showing that these superthermal electrons deposit their energy into plasma thermal energy in an expanding annular region in the target plane centered at the spot. The model provides a quantitative explanation for some complex and heretofore poorly understood lateral transport phenomenology.

45799 **Ambipolar electric field in stellarators.** Hastings, D.E.; Houlberg, W.A.; Shaing, K.C. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **25**: No. 4, 445-454(Apr 1985).

In a three-dimensional device like a stellarator, the ambipolar electric field must be determined self-consistently from the ambipolarity constraint and can have a significant effect on transport through the diffusion coefficients. A differential formulation and an algebraic formulation for the electric field are solved, together with the density and temperature equations. The results are compared, and in both cases multiple electric field solutions can exist, with bifurcations occurring between different solutions. It is shown that heating of the electrons encourages bifurcation to the more favourable positive electric field root.

45800 **Plasma confinement and heating in stellarators. Report on the 5. International Workshop - IAEA Technical Committee Meeting held at Schloss Ringberg (near Lake Tegern, Bavaria), Germany, F.R., 24-28 September 1984.** Callen, J.D. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering and Physics). *Nuclear Fusion;* **25**: No. 4, 485-493(Apr 1985).

This report presents the highlights of the Fifth International Workshop on Stellarators (September 1984, Bavaria); The workshop programme was organized into five sections: 1) Overview of experimental results; 2) Topical experimental details (heating, transport, impurities); 3) Theory (equilibrium and stability, transport); 4)

Machines under construction or approved; 5) Configuration and reactor studies. A summary of the latest developments is presented along these lines.

45801 **Numerical study of thermal equilibrium and a catastrophe model for major disruptions in tokamaks.** Yu, G.Y.; Guzdar, P.N.; Lee, Y.C. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). *Nuclear Fusion;* **25**: No. 4, 403-417(Apr 1985).

The thermal equilibrium of tokamak plasmas is studied by solving the electron and ion energy balance equations numerically. Three basic types of thermal equilibria, depending on different boundary temperatures, are found. The presence of a fold or cusp catastrophe structure of the equilibrium curves for temperature versus density in the case of low-boundary temperature indicates the existence of a density limit beyond which no equilibrium or only a trivial equilibrium exists. Major disruptions are considered to occur because of the loss of thermal equilibrium of the tokamak plasma. The study shows that major disruptions can be parametrically controlled. Thermal equilibria with higher boundary temperature display a monotonic structure of the temperature versus density curve, indicating good confinement characteristics and hence the absence of disruptions.

45802 **Low-energy beam pumping in TARA reactor design.** Xing-Zhong Li; Kesner, J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Nuclear Fusion;* **25**: No. 4, 425-433(Apr 1985).

The possibility of neutral-beam pumping in a tandem mirror thermal-barrier region is explored. To reduce the necessary neutral-beam pumping power, substituting low- for high-energy neutral beams is investigated. With the help of a two-step square well model and a variational expression for the trapping current, the competition between the trapping process and the drag effect for the deeply trapped particles is illustrated. This competition can lead to a stable equilibrium with reduced pumping power.

45803 **Fokker-Planck calculations for JET ICRF heating scenarios.** Scharer, J. (Wisconsin Univ., Madison (USA)); Jacquinot, J.; Lallia, P.; Sand, F. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). *Nuclear Fusion;* **25**: No. 4, 435-444(Apr 1985).

Flux-averaged ICRF heating of the JET tokamak is considered, utilizing an anisotropic, time-dependent Fokker-Planck code. Alternative ICRF heating scenarios are considered, and fundamental minority deuterium and second-harmonic tritium and deuterium cases are selected for detailed analysis of wave accessibility, strong single-pass damping and enhanced ion-tail-produced fusions. It is found that enhanced fusions, resulting from heated minority deuterium ion tails, and second-harmonic deuterium heating, yielding fusion power gains near Q=1, can be achieved near the plasma core with moderate absorbed power levels, pulse widths and energy confinement times. The corresponding case for second-harmonic tritium heating located on the major axis, with the associated fusion power gain, does not appear as attractive.

45804 **Enhancement of the reaction rate by ICRF heating.** Krapchev, V.B. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Nuclear Fusion;* **25**: No. 4, 455-461(Apr 1985).

ICRF heating at the second harmonic of deuterium in a D-T plasma produces an anisotropic tail of the deuterium ions in the direction perpendicular to the magnetic field. The non-Maxwellian distribution function leads to a significant enhancement of the reaction rate, corresponding to that of Maxwellian ions at much higher bulk temperature. The auxiliary power in the presence of ICRF is determined self-consistently from the power balance. It is shown that the enhanced reaction rate leads to savings in the peak power requirements.

45805 **Effects of varying wall conditions, minor and major radii on confinement properties in ISX-B.** Wootton, A.J.; Bush, C.E.; Edmonds, P.H.; Howe, H.C.; Lazarus, E.A.; Ma, C.H.; Murakami, M.; Neilson, G.H. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **25**: No. 4, 479-484(Apr 1985).

Letter-to-the-editor.

The Impurity Study Experiment (ISX-B) data base from which the energy confinement time scaling tausub(E)varies as to Isub(p)sup(3/2) Psub(b)sup(-2/3) was derived for neutral-beam-heated discharges has been enlarged. Results obtained by using a non-gettered vacuum vessel and different minor and major radii are now included. Energy confinement times improve and a density dependence is introduced, if gettering is not employed. There is an associated increase in impurity radiation. A comparison of confinement properties obtained by using two minor radii (approx. 19 cm and the usual approx. 26 cm) has been made. The correlation between radiation level and confinement is always found. No dependence of energy confinement on the minor radius is found. The confinement changes associated with wall conditions and radiation levels can be reproduced by using a gettered vessel and small plasma position displacements. In particular, outward radial displacements toward a limiter at the outer equator improve confinement. In this case, any radiation increase is small.

45806 **Rotation and impurity transport in a tokamak plasma with directed neutral-beam injection.** Stacey, W.M. Jr.; Bailey, A.W. (Georgia Inst. of Tech., Atlanta (USA)); Sigmar, D.J.; Shaing, K.C. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **25**: No. 4, 463-477(Apr 1985).

The authors have extended their previous collisional-regime theory for rotation and impurity transport in a tokamak plasma with strong, directed NBI and strong rotation (vsub(phi)approx. = vsub(th)) to the plateau regime. The paper gives a summary of a kinetic theory derivation of the parallel viscous force in the strong rotation ordering and a self-consistent formalism for calculating ion and impurity rotation velocities and radial transport fluxes, as well as the radial electric field and the poloidal variation of the impurity density upon which the former strongly depend. Calculations for model problems representative of ISX-B and PLT are presented. The predicted impurity transport exhibits features that are in agreement with experimental observations.

45807 **Hybrid-kinetic simulation of the generation of mass flow due to plasma-wall interaction in reversed-field pinches.** Mondt, J.P. (Los Alamos National Lab., NM (USA)); Hewett, D.W. (Lawrence Livermore National Lab., CA (USA)). *Plasma Physics and Controlled Fusion;* **27**: No. 3, 339-347(Mar 1985).

Flux loop and line density measurements in the reversed-field pinch ZT-40M indicate the existence of poloidally symmetric excitations in the edge that move in the direction anti-parallel to the toroidal current with a velocity of the order of the thermal ion speed. A recently proposed mechanism of momentum transfer between the plasma and the wall explains these observations by showing that plasma flow near the wall can be sustained over magneto-hydrodynamic time scales as a result of unidirectional transfer of momentum during a collision with the wall of an ion with finite gyroradius. The present hybrid-kinetic simulations substantiate the proposed mechanism by showing that within a few to ten microseconds flow of the required direction and order of magnitude results from collisions of ions with a momentum-absorbing wall.

45808 **Hot particle kinetic effects on ballooning in Tokamaks at high mode numbers.** Catto, P.J. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.); Hastie, R.J.; Connor, J.W. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.). *Plasma Physics and Controlled Fusion;* **27**: No. 3, 307-319(Mar 1985).

The equations describing short wavelength ballooning modes in a Tokamak are derived by retaining hot species finite Larmor radius effects and permitting the response of the hot populations to be evaluated for frequencies on the order of and below the hot particle magnetic drift frequency. The derivation relies on the high beta Tokamak ordering of a general system of equations that has been derived to investigate the role of the hot species in tandem mirrors and bumpy tori. Bounce averaging of the background ion species is shown to be unnecessary.

45809 **Ion-acoustic solitons in a multi component plasma: comparison of different theoretical models.** Raychaudhuri, S. (Iowa Univ., Iowa City (USA). Dept. of Electrical and Computer Engineering; Saha Inst. of Nuclear Physics, Calcutta (India)); Gabl, E.F. (Iowa Univ., Iowa City (USA). Dept. of Electrical and Computer Engineering; KMS Fusion, Inc., Ann Arbor, MI (USA)); Das, K.P. (Calcutta Univ. (India). Centre of Advanced Study in Applied Mathematics); Sengupta, S.N. (Saha Inst. of Nuclear Physics, Calcutta (India)). *Plasma Physics and Controlled Fusion;* **27**: No. 3, 299-306(Mar 1985).

Conditions for the existence of ion-acoustic solitons have been derived and studied for a warm multi-ion component plasma with two electron temperatures. The models: (a) Reductive perturbation method (using KdV equation), (b) Warm ion fluid theory and (c) Kinetic theory approach have been compared.

45810 **Effects of positive potential in the catastrophe theory study of the point model for bumpy tori.** Punjabi, A.; Vahala, G. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). *Journal of Plasma Physics;* **33**: 119-149(Feb 1985).

With positive ambipolar potential, ion non-resonant neoclassical transport leads to increased particle confinement times. In certain regimes of filling pressure, microwave powers (ECRH and ICRH) and positive potential, new folds can now emerge from previously degenerate equilibrium surfaces allowing for distinct C, T, and M modes of operation. A comparison in the equilibrium fold structure is also made between (i) equal particle and energy confinement times, and (ii) particle confinement times enhanced over the energy confinement time. The nonlinear time evolution of these point model equations is considered and confirms the delay convention occurrences at the fold edges. It is clearly seen that the time-asymptotic equilibrium state is very sensitive, not only to the values of the control parameters (neutral density, ambipolar electrostatic potential, electron and ion cyclotron power densities) but also to the initial conditions on the plasma density, and electron and ion temperatures.

45811 **Collective effects in spin polarized plasmas.** Coppi, B. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Massachusetts Inst. of Tech., Cambridge (USA)); Cowley, S.; Kulsrud, R. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Detragiache, P.; Pegoraro, F. (Scuola Normale Superiore, Pisa (Italy)). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 2, 49-62(Jan 1985).

A fusing plasma with coherently polarized spin nuclei can be subject to instabilities due to the anisotropy of the reaction products distribution in velocity space that is a result of their polarization. The characteristics of these instabilities depend strongly on the plasma spatial inhomogeneities and a significant rate of spin depolarization can be produced by them if adequate fluctuation amplitudes are reached. The results of the relevant analysis are, in addition, of interest for plasma heating processes with frequencies in the range of the cyclotron frequencies of the considered nuclei.

45812 **Excitation of the space charge waves in the laser beat wave accelerator.** Tang, C.M.; Sprangle, P. (Naval Research Lab., Washington, DC). pp 99-103 of Lasers '83. Proceedings of the international conference. Powell, R.C. McLean, VA; STS Press (1985). (CONF-831265—). Contract AI05-83ER40117.

From 6. international conference on lasers and applications; San Francisco, CA, USA (12 Dec 1983).

The excitation of plasma waves by two laser beams, whose frequency difference is approximately the plasma frequency, is analyzed. The nonlinear analysis is fully relativistic and includes mismatching of the laser beat frequency to the plasma frequency, time dependent laser amplitudes, and an applied transverse magnetic field (surfatron). For a given beat frequency, laser power, and plasma density, the peak accelerating electric field and its phase velocity has been found. The transverse magnetic field is found to increase the effective plasma frequency, but has little effect on the plasma dynamics. 9 references.

45813 **Plasma-fiber laser accelerator.** Tajima, T. (Texas Univ., Austin). pp 104-107 of Lasers '83. Proceedings of the international conference. Powell, R.C. McLean, VA; STS Press (1985). (CONF-831265—). Contract FG05-80ET53088.

From 6. international conference on lasers and applications; San Francisco, CA, USA (12 Dec 1983).

Under the conditions presently elucidated, a laser electromagnetic wave trapped in a plasma fiber is noted to be capable of exciting a beat plasma wave possessing a flat phase front which propagates either at the speed of light, or any desired lower speed. In the unique case where the fiber defines a vacuum, it remains possible to generate a wave whose phase velocity is nearly that of light in the direction of particle propagation, in the case of a plasma slow wave structure, or in curved geometry. While the laser field parallel component is used to impart acceleration, the perpendicular component is either cancelled by the imposed static magnetic field force or directly employed in particle containment. 8 references.

45814 **Plasma physics of the beam plasma discharge.** Papadopoulos, K. (Science Applications, Inc., McLean, VA (USA); Maryland Univ., College Park (USA)). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 1, 11-21(Nov 1984).

The scaling for the ignition of beam plasma discharge (BPD) observed in many laboratory experiments is consistent with the requirement for triggering an absolute instability near the plasma frequency (ωsub(e)). The transition in the scaling with pressure can be attributed to transition from Bohm to classical diffusion losses.

45815 **Axial energy loss of a moving ion ring in a plasma.** Sudan, R.N.; Lyster, P.M. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 1, 35-44(Nov 1984).

The axial drag on a moving ion ring in a plasma due to the generation of magnetohydrodynamic waves is calculated for large magnetic Reynolds number. The predicted stopping length checks reasonably with particle simulation computations.

45816 **Injection and trapping of energetic ions in compact torus configurations.** Sudan, R.N.; Lyster, P.M. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 1, 23-34(Nov 1984).

It is shown that energetic ions can be injected and trapped in CT configuration through collective effects. Once trapped, the injected ions may be accelerated by the CT flux decay or they may transfer energy to the CT plasma depending upon the CT/ring hybrid parameters.

45817 **X-ray spectroscopy from variable Z laser-produced plasmas.** Kauffman, R.L.; Lee, R.W.; Matthews, D.L. (Lawrence Livermore National Lab., CA (USA)); Kilkenny, J.D. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.). *Journal of Quantitative Spectroscopy and Radiative Transfer;* **32**: No. 4, 335-342(Oct 1984).

We have investigated the sensitivity of X-ray line intensities as a laser-plasma diagnostic by seeding Si in CH and PbO plasmas. The Si K X-ray spectrum is measured using both time-integrating and time resolving spectrographs to investigate the effect of time averaging on the line intensities. The measured intensities are compared with theoretical estimates for an isothermal, isodensity plasma. Si line intensities vary with the Z of the plasma, as expected from simple scaling models, indicating the Si lines can be a good plasma diagnostic. The line intensities do not predict a unique temperature and density, but, instead, the inferred temperature and density vary, depending on the line ratio used. These variations are attributed to large spatial gradients of temperature and density in the plasmas. Problems in interpretation are discussed, as well as possible directions for future experiments.

45818 Nonlinear waves in the pellet fusion process. Ervin, V.J.; Ames, W.F. (School of Mathematics, Georgia Institute of Technology, Atlanta (USA)); Adams, E. (Institut fuer Angewandte Mathematik, Karlsruhe Univ. (Germany, F.R.)). pp 199-210 of Wave phenomena: modern theory and applications. Papers presented at an international meeting held at the University of Toronto, June 20-24, 1983. Rogers, C. (Waterloo Univ., Ontario (Canada)); Moodie, T.B. (Alberta Univ., Edmonton (Canada)) (eds.). Amsterdam, Netherlands; North-Holland (1984). (CONF-8306143—).

From Wave phenomena conference; Toronto, Canada (20 Jun 1983).

A gas dynamic model of the pellet fusion process having a time-invariant source term is studied by means of group analysis. Some exact solutions of this nonlinear system are constructed for specific (physical) values of parameters. The development of multiple shock waves is demonstrated in several cases analytically. Additional numerical results illustrate the evolution of singularities.

45819 Cold plasma waves. Booker, H.G. Dordrecht, Netherlands; Martinus Nijhoff (1984). 364p.

Includes bibliographical references and subject index.

The book aims to present current knowledge concerning the propagation of electromagnetic waves in a homogeneous magnetoplasma for which temperature effects are unimportant. It places roughly equal emphasis on the radio and the hydromagnetic parts of the electromagnetic spectrum. The dispersion properties of a magnetoplasma are treated as a function both of wave frequency (assumed real) and of ionization density. The effect of collisions is included only in so far as this can be done with simplicity. The book describes how pulses are radiated from both small and large antennas embedded in a homogeneous magnetoplasma. The power density radiated from a type of dipole antenna is studied as a function of direction of radiation in all bands of wave frequency. Input reactance is not treated, but the dependence of radiation resistance on wave frequency is described for the entire electromagnetic spectrum. Also described is the relation between beaming and guidance for Alfven waves.

45820 (PPPL-TRANS—132) Dynamics of disruptive instability growth in a tokamak. Ivanov, N.V. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). May 1979. Contract AC02-76CH03073. Translation source information not available . 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017026.

This paper presents considerations concerning possible formation dynamics of voltage pulses in a discharge during disruptive instability in a tokamak, based on a model of relaxation oscillations of pulse current radial distribution profile. Increments of instability growth needed to explain the predisruptions and disruptions observed in experiments are evaluated. The results of assessments are compared with the values predicted by the theory for instabilities of various physical natures.

45821 (PPPL-TRANS—131) "Mode locking" of plasma helical instability in a tokamak. Ivanov, N.V. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). May 1979. Contract AC02-76CH03073. Translation source information not available . 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017020.

Considerations are presented concerning a possible mechanism of "mode locking" of plasma helical instability in a tokamak by an external alternating magnetic field. Frequency dependence of "locking" threshold, phase and amplitudes of "locked" mode are calculated for a model of a driven wave with a mixed amplitude.

45822 (PPPL-TRANS—130) Modeling of plasma heating with neutral beam injection in T-11 machine. Dnestrovskii, Yu.N.; Kostomarov, D.P.; Lysenko, S.T. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Apr 1979. Contract AC02-76CH03073. Translation of IAE-2978, 1978. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017016.

Computations of energy balance are presented for a tokamak with hot atom beam injection. Atom ionization, trapping of generated ions and energy transfer to plasma are examined. Energy loss in charge exchange is considered. Relationships are presented between the temperature and the injection power, the plasma density and other parameters. Possibilities are discussed for obtaining a collisionless ion regime.

45823 (PPPL-TRANS—128) Ion-cyclotron heating with low dissipation in T-10 tokamak. Alikaev, V.V.; Vdovin, V.L.; Lisenko, S.E.; Chesnokov, A.V.; Shapotkovskii, N.V. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Feb 1979. Contract AC02-76CH03073. Translation source information not available . 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017018.

This paper examines the problem of plasma heating in the T-10 tokamak using the second harmonic of ion-cyclotron frequency $\omega = 2\omega$/sub Bi/. There are several promising methods for heating in this frequency range, for example ion-ion hybrid resonance. We will, however, concentrate our attention in this paper on the study of fast wave heating methods under conditions of low dissipation using resonance pumping. Multi-mode character of plasma resonator is a characteristic feature of such a large machine with a dense plasma. It will be shown, therefore, that a comparatively small absorption spans over a majority of modes; this simplifies considerably the matching of the excitation device to the generator under the conditions of changing electron density. An important consequence of mode spanning at low dissipation is the localization of electromagnetic energy under the exciter.

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REFER ALSO TO CITATION(S) 44647, 44682, 44685, 45591, 45592, 45593, 45594, 45596

45824 (CONF-830795—10) Determination of the global recombination rate coefficient for the ISX-B Tokamak. Langley, R.A.; Howe, H.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016362.

From Symposium on energy removal and particle control and toroidal fusion devices; Princeton, NJ, USA (26 Jul 1983).

The global recombination rate coefficient for hydrogen has been measured for the ISX-B tokamak vacuum vessel for various surface conditions. The measurements were performed by observing the rate of decrease of gas pressure in the vessel during a glow discharge. The parameters of the glow discharge and the complete experimental method are described. Previously published analytic and numerical models are used for data analysis. The effects of surface contamination on the results are described. For "unclean" wall conditions σk/sub r/ = 1.8 x 10^{-38} cm^4/atom.s at 296 K and increases to σk/sub r/ = 4.4 x 10^{-38} cm^4/atoms.s for "clean" conditions and remains constant until subsequent exposure to air.

45825 (CONF-840614—106) Configuration review of TFCX design options. Brown, T.G. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016381.

From Annual meeting of the American Nuclear Society; New Orleans, LA, USA (3 Jun 1984).

As part of the preconceptual design effort of the Tokamak Fusion Core Experiment (TFCX), several candidate design options have been explored in order to identify a preferred option that will be developed in further detail during the conceptual design phase

of the TFCX program. The development of the TFCX concepts has been a collaborative effort between the Princeton Plasma Physics Laboratory (PPPL) and the Fusion Engineering Design Center (FEDC) with broad community input. The design options being considered include an all-superconducting design, a superconducting/copper toroidal field (TF) hybrid design, and several different all-copper configurations.

45826 **(CONF-850610—37) Compact DT fusion spherical tori at modest fields.** Peng, Y.K.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016415.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

A spherical torus is obtained by retaining only the indispensable components on the inboard side of a tokamak plasma, such as a cooled, normal conductor that carries current to produce a toroidal magnetic field. The resulting device features an exceptionally small aspect ratio (typically 2-to-1 elongation), and ramp-up and maintenance of the plasma current primarily by noninductive means. The tokamak plasma takes on the spherical shape with a modest hole through the center, suggesting the name of spherical torus. This paper reviews the initial assessments of near-term DT fusion devices based on the spherical torus concept.

45827 **(CONF-850610—41) Fusion materials activation characteristics as related to waste disposal requirements.** Conn, R.W.; Wiffen, F.W. (California Univ., Los Angeles (USA). School of Engineering and Applied Science; Oak Ridge National Lab., TN (USA)). 2 Jan 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016411.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

Lower activation materials for fusion reactors are technically possible, may be important to the public acceptance of fusion energy, and are a main goal of fusion energy development. Actual levels of radioactivation in a fusion reactor will depend on the material itself and on its alloying constituents and impurity content. The equilibrium activation level and post-shutdown decay rates affect three primary areas: long term waste material disposal; reactor maintainability, specifically, the prospects for limited hands-on or contact maintenance; and reactor safety. Goals relating to each of these three areas are proposed and used to develop four particular categories which classify both reactors and materials.

45828 **(CONF-850708—2) Simple procedure for establishing ignition conditions in tokamaks. Draft.** Uckan, N.A.; Sheffield, J. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016149.

From Workshop on tokamak start-up - problems and scenarios related to the transient phases of long-burn operations; Erice, Italy (14 Jul 1985).

Handwritten manuscript.

A method of establishing ignition conditions and plasma operating regimes over large regions of parameters space (R_0/a, b/a, aB_0^2/q, etc.) under various physics assumptions (chi/sub e/, chi/sub i/, q/sub psi/, β/sub crit/, n/sub crit/, etc.) with a simple systematic global model is presented. Contour plots of ignition, supplementary power, and plasma heating and operating windows are generated. These are then used to analyze the potential physics design space, operating regimes, and plasma performance characteristics of small ($R_0 \sim 1$ to 2 m), high field ($B_0 \sim 8$ to 13 T) ignition experiments that are currently being considered by the US Tokamak Ignition Design Studies.

45829 **(CONF-850813—1) Elastic and inelastic surface effects on ion penetration and the resulting sputtering and backscattering.** Hassanein, A.M.; Smith, D.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016604.

From 11. international conference on atomic collisions in solids; Washington, DC, USA (4 Aug 1985).

The computer code ITMC (Ion Transport in Materials and Compounds) has been developed to study in detail the transport of charged particles in solid materials and surface related phenomena such as sputtered atoms and backscattered ions. The code is based on Monte Carlo methods to follow the path and the damage produced by the charged particles in three dimension as they slow down in target materials. Single-element targets as well as alloys with possible different surface and bulk compositions or with layered structures of different materials can be used. Various models developed to calculate the inelastic energy losses with target electrons can be used in the code. Most known interatomic potentials can also be used to calculate the elastic energy losses. The major advantages of the code are its ability and flexibility to use and compare various models of elastic and inelastic energy losses in any target with different compounds and different surface and bulk composition.

45830 **(CONF-8505175—3) Modular tokamak reactor configuration.** Thomson, S.L.; Bussell, G.T.; Brown, T.G. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016399.

From TPSS meeting; Atlanta, GA, USA (15 May 1985).

The viewgraphs presented at this meeting on modular tokamaks are given. (MOW)

45831 **(CONF-8505175—4) Economy of scale.** Thomson, S.L.; Keeton, D.C. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016396.

From TPSS meeting; Atlanta, GA, USA (15 May 1985).

Viewgraphs are given relating the cost of electricity of coal, nuclear, and fusion power plants. (MOW)

45832 (DOE/ER—0113/4, pp 2-10) **Property studies of solid tritium breeding materials.** Johnson, C.E.; Fischer, A.K.; Tam, S.W.; Leibowitz, L.; Liu, Y.Y. (Argonne National Lab., IL). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this work is to evaluate the potential of lithium containing ceramic materials to serve as tritium breeding materials for D-T fusion reactors. This activity focuses on the collection and assessment of thermodynamic transport and thermophysical properties data on the candidate materials Li_2O, $LiAlO_2$, Li_4SiO_4, and Li_2ZrO_3. Studies include determining phase relationship, assessing transport behavior, measuring heats of adsorption/desorption, and determining chemical and thermal stability.

45833 (DOE/ER—0113/4, pp 11-15) **TRIO experiment.** Clemmer, R.G.; Scandora, A.E.; Finn, P.A.; Misra, B.; Billone, M.C.; Fischer, A.K.; Tam, S.W.; Johnson, C.E. (Argonne National Lab., IL). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this work is to test in-situ tritium recovery and heat transfer performance of a miniaturized solid breeder blanket. The TRIO experiment involves the irradiation of γ-$LiAlO_2$ under well defined conditions of temperature, neutron flux, sweep gas flow, and solid configuration. Tritium in its various chemical forms is moved by a sweep gas to an analytical train that measures and identifies the composition of the effluent. The predominant form of tritium observed in the sweep gas was the non-condensible, or HT form. At the completion of the experiment less than 0.1 wppm tritium was found in the solid.

45834 (DOE/ER—0113/4, pp 16-20) **FUBR-1A experimental results.** Hollenberg, G.W.; Baldwin, D.E. (Westinghouse Hanford Co., Richland, WA). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this effort was to obtain data on the performance of lithium ceramic materials during fast neutron irradia-

tion in support of solid breeder blanket designs. Irradiation results on Li_2O, $LiAlO_2$, Li_4SiO_4 and Li_2ZrO_3 have been obtained after irradiation in the fast neutron flux of EBR-II. Pellets of these materials were characterized by neutron radiography, mensuration, burnup measurement, helium retention measurement, and tritium retention measurement. The wide variations in retained helium, retained tritium and swelling measured in this experiment establishes the differences to be expected in these materials when used in solid breeder blankets.

45835 (DOE/ER—0113/4, pp 26-28) **Microstructural damage in neutron-irradiated spinel.** Tucker, D.S.; Zocco, T.; Parker, C.A.; Hobbs, L.W.; Russell, K.C. (Los Alamos National Lab., NM). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this work was to evaluate the damage microstructure of two forms of polycrystalline spinel, and relate the results to observations of strength changes in these ceramics and in a single-crystal form of this material. Two types of polycrystalline $MgAl_2O_4$ were irradiated to 2 x 10^{26} n/m^2, E > 0.1 MeV at 680 and 815 K. TEM examination revealed dense arrays of dislocation loops and denuded grain boundaries. These results are correlated with previously obtained strength data.

45836 (DOE/ER—0113/4, pp 29-32) **Facility for measuring microwave properties of radiation - damaged ceramics for RF windows and other fusion applications.** Frost, H.M. (Los Alamos National Lab., NM). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this work was to apply state-of-the-art hardware to measuring, both within waveguide and in free space, the dielectric constants and loss tangents at millimeter-wave frequencies of ceramics and other materials, especially those with low loss before and after fast-neutron irradiation. In response to materials needs connected with electron cyclotron resonance heating (ECRH) in magnetic fusion reactors, the facility at Los Alamos for electrical and dielectric properties measurements on materials is being upgraded to include a capability in the millimeter-wave region. Three chief-candidate hardware systems accordingly have been identified for measuring dielectric constants and loss tangents over at least a 10 GHz portion of the W-band (75-110 GHz). All three can process microwaves transmitted through materials, with loss tangents in the range of 0.001 to 0.0001. This includes the least accurate of the three systems, as confirmed by preliminary data on an unirradiated BeO matchstick specimen inserted within a WR-10 waveguide section in that system. Specimens of both alumina and beryllia have been irradiated in the EBR-II reactor to a fluence of 1 x 10^{26} n/m^2 (E > 0.1 MeV) at 385°C and are now available for testing.

45837 (DOE/ER—0113/4, pp 38-39) **Mechanical properties of candidate insulators for fusion reactors.** Tucker, D.S. (Los Alamos National Lab., NM). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this study was to determine the effects of neutron irradiation at 4.2 K on epoxy and polyimide insulators, and to compare these effects with those from gamma-irradiations at the same temperatures and in the same materials. Several epoxy- and polyimide-based materials were neutron-irradiated to a total dose of 2.6 x 10^{21} n/m^2 En > 0.1 MeV at 4.2 K in IPNS-II. Mechanical strength data revealed that only G-10CR exhibited significant degradation when tested at 77 K.

45838 (DOE/ER—0113/4, pp 40-44) **Strengths of unirradiated thin sheet organic laminate insulators loaded perpendicular to the laminations.** Becker, H.; Marston, P.G.; Montgomery, D.B.; Schmunk, R.J.; Tognarelli, D. (Massachusetts Institute of Technology, Cambridge). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this study was to determine the strengths of irradiated organic insulators and to construct a loading device for inpile strength determination. Thin disks of polyimide/S2 glass (PS2) laminate were irradiated to high neutron/gamma doses and were compressed perpendicular to the surface at room temperature. Two titanium loaders were transmitted to ORNL for initial measurements of radioactivity and gamma heating. Dose levels were high enough to reveal fall-off in fatigue life.

45839 (DOE/ER—0113/4, pp 46-50) **Progress on the establishment of a national low-temperature neutron irradiation facility (NLTNIF).** Coltman, R.R. Jr.; Klabunde, C.E.; Young, F.W. Jr. (Oak Ridge National Lab., TN). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this study was to assist in the design, construction, and operation of a National Low-Temperature Neutron Irradiation Facility (NLTNIF) for use in basic research and fusion magnet materials development. In May, 1983 the Division of Materials Sciences, Office of Basic Energy Sciences of the Department of Energy authorized the establishment of a National Low-Temperature Neutron Irradiation Facility (NLTNIF) at ORNL's Bulk Shielding Reactor (BSR). The NLTNIF, which will be available for qualified experiments at no cost to users, will provide a combination of high radiation intensities and special environmental and testing conditions that have not been previously available in the US. Since the DOE authorization, work has proceeded on the design and construction of the new facility without interruption. The present status of the development of NLTNIF is described and, for the information of new candidate users, a recounting of the major specifications and capabilities is also given.

45840 (DOE/ER—0113/4, pp 51-57) **Materials and test methods.** Kase, M.B. (National Bureau of Standards, Washington, DC). May 1985. NTIS, PC A04/MF A01. File Number DE85013529.

In Seventh annual progress report on special purpose materials for magnetically confined fusion reactors.

The objective of this study was to provide, in cooperation with ORNL and LANL, specimens required for studies to develop organic insulators having the cryogenic neutron irradiation resistance required for MFE systems utilizing superconducting magnetic confinement. To develop test methods and analytical procedures for assessing radiation damage. To stimulate and participate in international cooperation directed toward accomplishing these objectives. The system for producing uniaxially reinforced, 3-4 mm (0.125 in) diameter rod specimens has been refined and validated by production of excellent quality specimens using liquid-mix epoxy resin systems. The methodology is undergoing further modification to permit use of hot-melt epoxy and polyimide resin systems as will be required for the experimental program to be conducted in the NLTNIF reactor at ORNL. Preliminary studies indicate that short beam and torsional shear test methods will be useful in evaluating radiation degradation. Development of these and other applicable test methods are continuing. A cooperative program established with laboratories in Japan and in England has resulted in the production and testing of specimens having an identical configuration.

45841 (DOE/ET/52040—T22) **CTR plasma engineering studies. Annual progress report, 1 December 1984-30 November 1985.** Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1985. Contract AC02-76ET52040. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85016582.

Work under this project is focused on plasma engineering developments in support of fusion reactor studies. The work described in this annual progress report covers a variety of topics ranging from plasma transport modelling for compact tori to radiation heating of the first wall in a fusion device. Sections 2 and 3 decribe computer codes developed for use with field-reversed configurations such as spheromaks and field-reversed mirrors. Section 4 presents an evaluation of the feasibility of heating a RFP-type reactor to ignition with ohmic current input alone. Sections 5 and 6 describe new work that has been initiated on optimal control theory for fusion reactors. Sections 7 to 9 discuss recent results on alpha-

particle transport, instabilities, and diagnostics. In the final section, methods for analysis of the poloidal variation in the thermal wall loading of a tokamak reactor are discussed and some typical results are presented.

45842 **(ECN—162) FURNACE; a toroidal geometry neutronic program system method description and users manual.** Verschuur, K.A. (Netherlands Energy Research Foundation, Petten). Dec 1984. 92p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85702040.

Work partially supported by the European Communities.

The FURNACE program system performs neutronic and photonic calculations in 3D toroidal geometry for application to fusion reactors. The geometry description is quite general, allowing any torus cross section and any neutron source density distribution for the plasma, as well as simple parametric representations of circular, elliptic and D-shaped tori and plasmas. The numerical method is based on an approximate transport model that produces results with sufficient accuracy for reactor-design purposes, at acceptable calculational costs. A short description is given of the numerical method, and a user manual for the programs of the system: FURNACE, ANISN-PT, LIBRA, TAPEMA and DRAWER is presented.

45843 (INIS-mf—9306, pp L23) **Muon-catalyzed fusion with high-density d-t gas mixtures.** Caffrey, A.J.; Anderson, A.N.; Jones, S.E.; Walter, J.B.; Watts, K.D. (Idaho National Engineering Lab., Idaho Falls (USA)); Bradbury, J.N.; Gram, P.A.M.; Leon, M.; Maltrud, H.R.; Paciotti, M.A. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45844 (INIS-mf—9306, pp L24) **Resonant formation of muonic hydrogen molecules and muon induced fusion in D/T mixtures.** Breunlich, W.H.; Cargnelli, M.; Kammel, P.; Marton, J.; Pawlek, P.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Janett, A.; Petitjean, C. (Schweizerisches Inst. fuer Nuklearforschung, Villigen); Sherman, R.H. (Los Alamos National Lab., NM (USA)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45845 (INIS-mf—9306, pp L25) **Investigation of muon catalyzed dd- and dt-fusion processes.** Balin, D.V.; Maev, E.M.; Markov, A.A.; Medvedev, V.I.; Semenchuk, G.G.; Smirenin, Yu.V.; Vorobyov, A.A.; Vorobyov, A.A.; Zalite, Yu.K. (Leningrad Inst. of Nuclear Physics, Gatchina (USSR)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781517. (CONF-840789—Vol.2-Absts.).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

45846 **(INIS-mf—9749) Surface generation of negative hydrogen ion beams.** Bommel, P.J.M. van. (Amsterdam Univ. (Netherlands)). 6 Jun 1984. 184p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85781544.

Includes Dutch summary; 180 refs.; 52 figs.; 4 tabs.

This thesis describes investigations on negative hydrogen ion sources at the ampere level. Formation of H^- ions occurs when positive hydrogen ions capture two electrons at metal surfaces. The negative ionization probability of hydrogen at metal surfaces increases strongly with decreasing work function of the surface. The converters used in this study are covered with cesium. Usually there are 'surface plasma sources' in which the hydrogen source plasma interacts with a converter. In this thesis the author concentrates upon investigating a new concept that has converters outside the plasma. In this approach a positive hydrogen ion beam is extracted from the plasma and is subsequently reflected from a low work function converter surface.

45847 **(IPP—2/273) Thermomechanical layout of the NET first wall assembly.** Mukherjee, S.B. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jan 1985. 101p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85751879.

With 62 figs.

The 2D-finite element (FE) method is applied for the NET first wall structure to compute the quasi-harmonic steady-state temperature distribution within the wall and to determine the nonlinear elastic stresses under thermomechanical loads. 26 different cases (as proposed) have been investigated for the structure containing plane wall, grooved wall and thin wall concepts, respectively. The wall's support condition and the nonlinear material and thermal parameters are varied. The computations are carried out once with water coolant and then with high pressure helium coolant. The results are documented in this final report.

45848 **(IPP—6-245) Analytical approximation formulae for hydrogen diffusion in a metal slab.** Pohl, F.; Bohdansky, J. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1984. 92p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752082.

This report treats hydrogen diffusion in the first wall of a fusion machine (INTOR, reactor, etc.), taking the thermal load into account. Analytical approximation formulae are given for the concentration and flux density of hydrogen diffusing through a plane metal slab. The re-emission flux, particularly during the dwell time(s) of machine operation, is also described with analytical formulae. The analytical formulae are compared with numerical calculations for steel as first wall material.

45849 **(KFK—3834) Safety aspects of an inertial confinement fusion reactor.** Kessler, G.; Schlechtendahl, E.G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jan 1985. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751900.

Releases into the environment of radioactive materials contained in heavy ion fusion (HIF) reactor plants must be prevented by similar safety design concepts as they are applied to present fission converter (e.g. LWR's) and breeder reactors (LMFBR's). This study is intended to identify significant safety aspects of inertial confinement fusion power plant concepts and to relate them to the more familliar basis of knowledge about the safety and the hazards of other advanced nuclear power reactor systems such as the LMFBR. Needs for safety related research and development specifically for inertial confinement fusion are pointed out.

45850 **(LA-UR—85-2077) Design and performance of large area monolithic electron guns for the Aurora KrF laser system.** Kang, M.; Rosocha, L.A.; Romero, V.O.; Van Haaften, F.W.; Brucker, J.P. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-850616—68). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014112.

From 5. IEEE pulsed power conference; Washington, DC, USA (10 Jun 1985).

Aurora is an inertial confinement fusion laser system using optical angular multiplexing and a chain of four cold cathode electron beam driven KrF laser amplifiers to produce 10 to 20 kJ of optical energy.

45851 **(LA-UR—85-2245) Aurora project: optical design for a kilojoule class KrF laser.** Hanlon, J.; McLeod, J.; Sollid, J.E.; Horn, W. III; Carmichael, R.; Kortegaard, B.; Woodfin, G.; Rosocha, L.. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850345—26). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014078.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

Aurora is a 248-nm, 10-kilojoule laser system being built at Los Alamos National Laboratory to demonstrate the feasibility of

large KrF laser systems for laser fusion. It was designed as a test bed to demonstrate: (1) efficiet energy extraction at 248 nm; (2) an angularly multiplexed optical system that is scaleable to large system designs; (3) the control of parasitics and ASE (amplified spontaneous emission); (4) long path pulse propagation at uv wavelengths; (5) alignment systems for multibeam systems; and (6) new or novel approaches to optical hardware that can lead to cost reduction on large systems. In this paper only issues pertinent to the optical system are addressed. First, a description of the entire system is given. The design constraints on the optical system are explained, concurrent with a discussion of the final design. This is followed by a very brief discussion of coatings; in particular, the use of sol-gels for antireflection coatings is presented.

45852 **(LA-UR—85-2351) Installation alignment of a multi-beam ICF target illumination system.** Bauke, W.; Stahl, D.B. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850345—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015677.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

Target illumination systems for inertial confinement fusion (ICF) experiments require precise alignment of a multitude of mirrors, usually spherically arranged around the ICF target. The mechanical support structure for these mirrors generally consists of a large space frame with many voids. This makes direct alignment or boresighting impossible, since alignment instruments and references cannot be placed at the coordinate centers representing the mirror arrays or focal points. Nevertheless, the structural members must be accurately aligned during the assembly phase, to provide the focusing precision required by the completed illumination system. This paper describes the techniques used to assemble and align the Antares Laser space frame where a total of 48 mirrors fold and focus 24 laser beams onto the ICF target, within a 7.3 meter space frame. The alignment procedures described use optical tooling and test techniques supplemented by surveying instruments and auxiliary devices, as required by the unique geometry of the space frame.

45853 **(LA-UR—85-2485) Measurement of Faraday rotation in twisted optical fiber using rotating polarization and analog phase detection.** Chandler, G.I.; Forman, P.R.; Jahoda, F.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-850887—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015704.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

We demonstrated phase modulation of rotating linearly polarized light by current-induced Faraday rotation in a single mode optical fiber and used the technique to measure the current in ZT-40M, a Reversed-Field Pinch. We have also demonstrated the practicality of using twisted sensing fiber to overcome the problems associated with linear birefringence.

45854 **(LBL—19501) Heavy ion fusion half year report, October 1, 1984-March 30, 1985.** (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017257.

Summaries of research are given for each of the following experiments: (1) MBE-4: a four-beam induction linac experiment, (2) performance of the MBE-4 injector, (3) design procedure for acceleration and bunching in an induction linac, (4) longitudinal dynamics of MBE-4, (5) transverse beam dynamics, (6) envelope functions of high-current beam, (7) electrostatic energy analyzer, (8) longitudinal beam control, (9) a capacitive beam-charge monitor for SBTE, (10) materials R and D, (11) simulations of Robertson's lens, and (12) SBTE high σ_0 high-current stability limits. (MOW)

45855 **(LBL—19529) LBL neutralized beam focusing experiment.** Krafft, G.A.; Kim, C.H.; Smith, L. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—240). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016564.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An intense neutralized Cs^{+1} beam has been focused by an electrostatic polarization field induced by a solenoidal magnetic field of 10-25 gauss. This report describes the experiment and compares the results with the predictions of an analytic linearized fluid model and a particle-in-cell simulation which treats the motion of the warm electrons in detail.

45856 **(LBL—19647) Measurements of stability limits for a space-charge-dominated ion beam in a long A.G. transport channel.** Tiefenback, M.G.; Keefe, D. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—241). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016636.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The Single Beam Transport Experiment at LBL consists of 82 electrostatic quadrupole lenses arranged in a FODO lattice. Five further lenses provide a matched beam from a high-current high-brightness cesium source for injection into the FODO channel. We call the transport conditions stable if both the emittance and current remain unchanged between the beginning and end of the channel, and unstable if either the emittance grows or the current decreases because of collective effects. We have explored the range of single-particle betatron phase advance per period from $\sigma_0 = 45^0$ to 150^0 to determine the stability limits for the space-charge depressed phase advance, σ. No lower limit for σ (down to 7^0) has been found at $\sigma_0 = 60^0$, whereas limits have clearly been identified and mapped in the region of σ_0 above 90^0.

45857 **(PPPL—2224) Confinement studies in TFTR.** Murakami, M.; Arunasalam, V.; Bell, J.D.; Bell, M.G.; Bitter, M.; Blanchard, W.R.; Boody, F.; Boyd, D.; Bretz, N.; Bush, C.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1985. Contract AC02-76CH03073. 9p. (CONF-850310—116). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015305.

From 6. topical meeting on the technology of fusion energy; San Francisco, CA, USA (3 Mar 1985).

The paper describes the present (end of February 1985) status of the plasma confinement studies in the TFTR tokamak with emphasis on those with neutral beam injection (NBI). Recent improvements in the device capabilities have substantially extended operating parameters: B/sub T/ increased to 4.0 T, I/sub p/ to 2.0 MA, injection power (P/sub b/) to 5 MW with H^0 or D^0 beams anti n/sub e/ to 5 x 10^{19} m^{-3}, and Z/sub eff/ reduced to 1.4. With ohmic heating (OH) alone, the previously established scaling for gross energy confinement time (tau/sub E/ = anti n/sub e/q) has been confirmed at higher I/sub p/ and B/sub T/, and the maximum tau/sub E/ of 0.4 sec has been achieved. With NBI at P/sub b/ substantially (by factor >2) higher than P/sub OH/, excellent power and particle accountability have been established. This suggests that the less-than-expected increase in stored energy with NBI is not due to problems of power delivery, but due to problems of confinement deterioration. tau/sub E/ is observed to scale approximately as I/sub p/ P/sub b//sup -0.5/ (independent of anti n/sub e/), consistent with previous L-mode scalings. With NBI we have achieved the maximum tau/sub E/ of 0.2 sec and the maximum T/sub i/(o) of 4.4 keV in the normal operating regime, and even higher T/sub i/(o) in the energetic-ion regime with low-n/sub e/ and low-I/sub p/ operation.

45858 **(UCID—20166-Vol.5) Special topics reports for the reference tandem mirror fusion breeder. Volume 5. Neutronic issues and optimization.** Lee, J.D.; Bandini, B.R. (Lawrence Livermore National Lab., CA (USA)). 29 Mar 1985. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017149.

More rigorous nuclear analysis, including the treatment of resonance self-shielding effects coupled with an optimization procedure, has resulted in improved performance of the Be/Li/Th blanket. Net U-233 breeding ratio has increased 36% (to 0.84) while at a U/Th ratio of 0.25 a/o energy multiplication has increased 12% (to 2.1) compared with earlier results.

45859 **(UCID—20274-Vol.1) Summary of TMX-U results, 1984. Volume 1.** Simonen, T.C. (ed.). (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1984. Contract W-7405-ENG-48. 522p. NTIS, PC A22/MF A01; 1; GPO Dep. File Number DE85017286.

This progress report describes results from the upgraded Tandem Mirror Experiment (TMX-U), which began in May 1982, following the completion and checkout of modifications to the TMX facility. These modifications allowed us to carry out proof-of-principle experiments on the thermal-barrier method of tandem mirror end-plugging. As defined in the TMX-U proposal, the physics objectives of TMX-U were to: (1) Investigate a complete tandem-mirror thermal-barrier system: (a) demonstrate end-plug microstability, (b) investigate magnetohydromic MHD stability, (c) develop electron-cyclotron resonance heating (ECRH), create mirror-confined end-cell electrons, and generate end-plug plasma potentials, and (d) demonstrate the electron temperature gradient across the thermal barrier; and (2) Improve TMX performance.

45860 **(UCRL—15700-Vol.1) Mirror Fusion Test Facility-B (MFTF-B) axicell configuration: NbTi magnet system. Design and analysis summary. Volume 1.** Heathman, J.H.; Wohlwend, J.W. (General Dynamics Corp., San Diego, CA (USA). Convair Div.). May 1985. Contract W-7405-ENG-48. 408p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85017283.

This report summarizes the designs and analyses produced by General Dynamics Convair for the four Axicell magnets (A1 and A20, east and west), the four Transition magnets (T1 and T2, east and west), and the twelve Solenoid magnets (S1 through S6, east and west). Over four million drawings and specifications, in addition to detailed stress analysis, thermal analysis, electrical, instrumentation, and verification test reports were produced as part of the MFTF-B design effort. Significant aspects of the designs, as well as key analysis results, are summarized in this report. In addition, drawing trees and lists off detailed analysis and test reports included in this report define the locations of the detailed design and analysis data.

45861 **(UCRL—92087) Thin-thick quadrature frequency conversion.** Eimerl, D. (Lawrence Livermore National Lab., CA (USA)). 7 Feb 1985. Contract W-7405-ENG-48. 4p. (CONF-850174—2). NTIS, PC A02. File Number DE85012977.

From Lasers '84; San Francisco, CA, USA (15 Jan 1985).

The quadrature conversion scheme is a method of generating the second harmonic. The scheme, which uses two crystals in series, has several advantages over single-crystal or other two crystal schemes. The most important is that it is capable of high conversion efficiency over a large dynamic range of drive intensity and detuning angle.

45862 **Novette facility: activation and experimental results.** Manes, K.R.; Barr, O.C.; Bliss, E.S. (Lawrence Livermore National Lab., CA (USA)). *Laser and Particle Beams;* **3**: 173-188(May 1985).

From the neodymium glass laser system Novette with two beams of 74 cm diameter and 18 kJ energy per pulse output in the nanosecond range, the design, the steps of the construction, and results of the system are reported. The two beams are synchronized to 5 psec and conversion to green light up to 78% has been realized. Conversion to four times the laser frequency is measured with more than 25% conversion. Simulation and measurement of laser beam properties at several locations permit an analysis to define the final Nova configuration. About half of Novette's experiments were to study short wave length laser-plasma interactions for the then better coupling by inverse bremsstrahlung mechanisms for inertial confinement fusion with laser intensities up to 10^{17}W/cm^2. Experiments were divided between high density implosion research and non-local thermodynamic equilibrium plasma conditions.

45863 **Ponderomotive and thermal filamentation of laser light.** Kruer, W.L. (Lawrence Livermore National Lab., CA (USA)). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 2, 63-72(Jan 1985).

Ponderomotive and thermal filamentation of laser light are potentially important processes in targets with large regions of underdense plasma. These processes are compared, threshold intensities are estimated, and some possible consequences are discussed.

45864 **Observation of enhanced particle removal rates in pump limiter simulation experiments.** Goebel, D.M.; Conn, R.W. (California Univ., Los Angeles (USA). School of Engineering and Applied Science; California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). *Journal of Nuclear Materials;* **128/129**: 249-252(Dec 1984). (CONF-840520—). Contract AA03-76SF00034;AT03-84ER52104.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The performance of particle removal schemes for density and impurity control in tokamaks and mirror machines depends strongly on the plasma parameters and local recycling near the plasma neutralizer plates and gas pumping ducts. The relationship between plasma density, electron temperature, ion energy and gas flow and particle removal rate through a pumping duct located near a plasma neutralizer plate has been experimentally investigated in the steady state plasma device PISCES. Results indicate that initially the particle removal by pumps at the end of the duct is proportional to the plasma flux to the plate. A nonlinear increase in the pumping rate occurs when the ionization mean free path for neutrals from the plate becomes less than the plasma radius. The transition from a transparent to an opaque plasma due to local ionization of the neutrals produced at the neutralizer plate greatly enhances the particle removal rate by recycling of the neutral gas as it flows away from the neutralizer plate or out of the pumping ducts. Parameters were varied to determine the importance of 'ballistic scattering' of higher energy ions from the plate, but no effects were found in these experiments.

45865 **Time-resolved erosion measurements at a reference limiter in ISX-B using laser-induced fluorescence.** Cook, T.B.; King, P.W.; Roberto, J.B.; Stewart, K.A.; Yokoyama, K.E. (Oak Ridge National Lab., TN (USA)). *Journal of Nuclear Materials;* **128/129**: 253-256(Dec 1984). (CONF-840520—). Contract AC05-84OR21400.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Laser-induced fluorescence has been used to measure the density and ionization length of neutral metal atoms released from a reference limiter during plasma discharges in the Impurity Study Experiment (ISX-B) tokamak. A tunable, pulsed laser beam is introduced into the tokamak at the midplane along a major radius and passes in front of a stainless steel reference limiter positioned between the wall and the main limiter radius. Neutral iron atoms released from the limiter are detected by saturation pumping of the ground-state transition at 302 nm, followed by off resonance detection of the resulting fluorescence radiation. The sampling rate is 15 Hz; additional time resolution is provided by overlaying similar discharges with different time synchronization. In ohmic discharges in ISX-B, a nearly constant impurity release rate of 8×10^{14} cm^{-2} s^{-1} occurs during the steady-state part of the discharge, with substantial peaks during the breakdown, rampup, and termination of the shot. Measured ionization lengths are suggestive of particle velocities typical of sputtering. These results are presented with similar data from neutral-beam-heated shots.

45866 **Ergodic magnetic limiter experiments on TEXT with a 7/3 resonance.** DeGrassie, J.S.; Ohyabu, N.; Brooks, N.H. (GA Technologies, Inc., San Diego, CA (USA)); Gentle, K.W.; Bengston, R.; Bravenec, R.; Hodge, W.; Kochanski, T.; Nelin, K.; Phillips, P. *Journal of Nuclear Materials;* **128/129**: 266-270(Dec 1984). (CONF-840520—). Contract AC03-84ER51044.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The ergodic magnetic limiter coils on TEXT have been reconfigured to produce the primary helical perturbation resonance at $m = 7/n = 3$. The experiments continue to demonstrate that the weak resonant perturbations modify the edge conditions in keeping with model predictions. We observe a reduction in the intrinsic impurity levels accompanying the helical current pulse, presumably the result of a reduction in the electron temperature in the edge.

Heat follows the perturbed field lines to the limiter, generating heat load patterns which reflect the geometry of a magnetic island-limiter intersection. A strong spatial modulation of the electron density in the scrape-off-layer also reflects the helical mode structure.

45867 **Means of varying conditions in the expanded boundary divertor without affecting energy confinement.** Burrell, K.H.; Ohyabu, N.; Chase, R.; Kahn, C.; Petrie, T. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 275-279(Dec 1984). (CONF-840520—). Contract AC03-84ER51044.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Expanded boundary divertor discharges in Doublet III have shown a significant enhancement in confinement-relative to limiter discharges with similar plasma density, current, toroidal field and neutral beam heating power. This improvement is insensitive to divertor density, recycling rate and power radiated from the divertor. Accordingly, it may be possible to exploit the improved divertor confinement in a fusion reactor while independently adjusting conditions in the divertor to satisfy reactor engineering constraints.

45868 **Plasma-materials interactions during RF experiments in tokamaks.** Cohen, S.A.; Bernabei, S.; Budny, R.; Chu, T.K.; Colestock, P.; Hinnov, E.; Hooke, W.; Hosea, J.; Hwang, D.; Jobes, F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **128/129**: 280-291(Dec 1984). (CONF-840520—). Contract AC02-76CH03073.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Plasma-materials interactions studied in recent ICRF heating and lower hybrid current drive experiments are reviewed. The microscopic processes responsible for impurity generation are discussed. In ICRF experiments, improvements in machine operation and in antenna and feedthrough design have allowed efficient plasma heating at RF powers up to 3 MW. No significant loss of energy from the plasma core due to impurity radiation occurs. Lower hybrid current drive results in the generation and maintenance of hundreds of kiloamperes of plasma current carried by suprathermal electrons. The loss of these electrons and their role in impurity generation are assessed. Methods to avoid this problem are evaluated.

45869 **Design and analysis of a low-edge-temperature divertor for INTOR.** Brooks, J.N.; Mattas, R.F.; Hassanein, A.M. (Argonne National Lab., IL (USA). Fusion Power Program); Baskes, M.I. (Sandia National Labs., Livermore, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 400-406(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A low edge temperature regime has been proposed for the INTOR divertor in order to minimize erosion on the collector plate. We have examined the design and lifetime issues of a divertor plate operating in such a regime. These issues include the choice of materials, erosion due to sputtering and disruptions, thermal response, and tritium permeation. We have concluded that a tungsten-coated, copper substrate plate offers the possibility of low erosion coupled with good thermal properties. However, there are many unresolved issues with this and other plate configurations. These issues include the transfer of first wall sputtered material to the plate, tritium permeation into the coolant, and mechanical problems such as radiation swelling and embrittlement.

45870 **Tokamak pump limiters.** Conn, R.W. (California Univ., Los Angeles (USA). School of Engineering and Applied Science; California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). *Journal of Nuclear Materials;* **128/129**: 407-417(Dec 1984). (CONF-840520—). Contract AA03-76SF00034;AS03-80ER52062.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Recent experiments with a scoop limiter without active internal pumping have been carried out in the PDX tokamak with up to 6 MW of auxiliary neutral beam heating. Experiments have also been performed with a rotating head pump limiter in the PLT tokamak in conjunction with RF plasma heating. Extensive experiments have been done in the ISX-B tokamak and first experiments have been completed with the ALT-I limiter in TEXTOR. The pump limiter modules in these latter two machines have internal getter pumping. Experiments in ISX-B are with ohmic and auxiliary neutral beam heating. The results in ISX-B and TEXTOR show that active density control and particle removal is achieved with pump limiters. In ISX-B, the boundary layer (or scrape-off layer) plasma partially screens the core plasma from gas injection. In both ISX-B and TEXTOR, the pressure internal to the module scales linearly with plasma density but in ISX-B, with neutral beam injection, a nonlinear increase is observed at the highest densities studied. Plasma plugging is the suspected cause. Results from PDX suggest that a regime may exist in which core plasma energy confinement improves using a pump limiter during neutral beam injection. Asymmetric radial profiles and an increased edge electron temperature are observed in discharges with improved confinement. The injection of small amounts of neon into ISX-B has more clearly shown an improved electron core energy confinement during neutral beam injection. While carried out with a regular limiter, this 'Z-mode' of operation is ideal for use with pump limiters and should be a way to achieve energy confinement times similar to values for H-mode tokamak plasmas. The implication of all these results for the design of a reactor pump limiter is described.

45871 **ISX-JET beryllium limiter experiment.** Edmonds, P.H.; Mioduszewski, P.K.; Roberto, J.B. (Oak Ridge National Lab., TN (USA)); Watson, R.D.; Smith, M.F. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Nuclear Materials;* **128/129**: 422-424(Dec 1984). (CONF-840520—). Contract AC05-84OR21400;AC04-76DP00789.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A description is given of an experiment that has been designed for the ISX-B tokamak at the Oak Ridge National Laboratory using beryllium as the primary plasma limiter.

45872 **High energy and particle confinement times in PDX scoop discharges.** Budny, R.; Bol, K.; Fonck, R.; Goldston, R.; Grek, B.; Heidbrink, W.; Heifetz, D.; Johnson, D.; Kaita, R.; Kaye, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **128/129**: 425-429(Dec 1984). (CONF-840520—). Contract AC02-76CH03073.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Scoop limited discharges in PDX with neutral beam heating achieved energy and particle confinement times higher than those inferred from similar poloidal rail limiter discharges. We present transport simulations using TRANSP and BALDUR and neutral simulations using DEGAS. Large neutral densities and ionization rates localized near the scoop are inferred. Thermal neutral ionization increases the edge electron density substantially, resulting in a flattened density profile. Fueling from the scoop limiter is deeper than from simple limiters.

45873 **PLT rotating pumped limiter.** Cohen, S.A.; Budny, R.V.; Corso, V.; Boychuck, J.; Grisham, L.; Heifetz, D.; Hosea, J.; Luyber, S.; Loprest, P.; Manos, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **128/129**: 430-433(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A limiter with a specially contoured front face and the ability to rotate during tokamak discharges has been installed in a PLT pump duct. These features have been selected to handle the unique particle removal and heat load requirements of ICRF heating and lower-hybrid current-drive experiments. The limiter has been conditioned and commissioned in an ion-beam test stand by irradiation with 1 MW power, 200 ms duration beams of 40 keV hydrogen ions. Operation in PLT during ohmic discharges has proven the ability of the limiter to reduce localized heating caused by energetic electron bombardment and to remove about 2% of the ions lost to the PLT walls and limiters.

45874 Initial ALT-I pump limiter studies on TEXTOR. Pontau, A.E.; Guthrie, S.E.; Malinowski, M.E.; Ver Berkmoes, A.A.; Whitley, J.B.; McDonald, J.M.; Watson, R.D.; Gauster, W.B. (Sandia National Labs., Livermore, CA (USA); Sandia National Labs., Albuquerque, NM (USA)); Campbell, G.A. *Journal of Nuclear Materials;* **128/129**: 434-439(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The ALT-I pump limiter has been used to control the fueling and recycling characteristics of TEXTOR during stable, reproducible tokamak discharges. The module has been operated in three modes: (1) normal limiter, with no particle collection, (2) particle scoop, with a maximum proportional 2 x 10^{-3} Torr pressure rise in the 700 l unpumped collection chamber, and (3) pump limiter, with up to proportional 10 000 l/s pumping speed and particle removal rates of up to 6 x 10^{20}/s. In a comparison of operation in modes (1) and (3) using identical gas fueling programs, the total core electron number decreased by as much as 50%. The effective TEXTOR particle confinement time, tausub(p)sup(*) = tausub(p)/(1-R), was decreased by a similar ratio. Within the throat region, during typical operation, electron densities and temperatures were 6 x 10^{11}-2 x 10^{13}/cm^3 and 15-30 eV. These conditions are representative of an operating regime in which there is high reionization of neutrals, but no change in incoming plasma parameters in the throat region. Energetic particles near the deflector plate were observed. During a gradual insertion of TiC-coated ALT-I beyond the stainless steel TEXTOR main limiters, the density of Ti in the plasma increased to a level similar to those of Cr and Fe. The gas injection fueling efficiency while puffing hydrogen directly into the plasma at the pump limiter tangency point was measured to be >0.9. These results are discussed in conjunction with measurements of particle flow within ALT-I and other plasma diagnostics to characterize pump limiter operation on TEXTOR.

45875 Monte Carlo simulation of the ISX pumped limiter. Evans, K. Jr. (Argonne National Lab., IL (USA). Fusion Power Program); Heifetz, D.; Post, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Mioduszewski, P.K. (Oak Ridge National Lab., TN (USA)). *Journal of Nuclear Materials;* **128/129**: 452-457(Dec 1984). (CONF-840520—). Contract AC02-76CH03073.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

This paper presents the results of Monte Carlo simulations of the neutral particle transport inside the pumped limiters installed on the ISX Tokamak. An overview is given of both the experiment and the computer code, DEGAS, used for the calculations. Two configurations of the limiters are treated in both the pumped and the unpumped modes. A variety of scrape-off densities and temperatures typical of those observed experimentally are considered. A number of quantities of interest are calculated including the fate of the neutralized particles, the particle confinement time in the chamber, and the recycling at the neutralizer plate as well as the neutral densities, temperatures, and pressures. The calculated pressures are found to be somewhat larger than those measured. The discrepancy is most probably due to uncertainty in the current of ions to the neutralizer plate. The calculations are limited by the inability to include the changes in the plasma parameters due to the neutral processes and by the 2D nature of the code compared with the definitely 3D nature of the limiters. The results and their significance in the understanding of the limiter behavior are discussed.

45876 Big Dee divertor and pump limiter capabilities. Mahdavi, M.A.; Eames, D.; Brown, B.; Davis, L.; Helton, F.J.; Luxon, J.; McKelvey, T.; Stambaugh, R.; Steeger, E.; Taylor, T. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 466-469(Dec 1984). (CONF-840520—). Contract AC03-84ER51044.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The Big Dee device will be the first major tokamak to incorporate both divertor and pump limiter particle control techniques. The Big Dee is an upgrade of the Doublet III facility designed to reach reactor grade plasma parameters. The device, presently under construction, is designed to operate at plasma current of Isub(p) <= 5 MA (3.5 MA if diverted), input power of 20 MW, and pulse duration of several seconds with either divertor or pump limiters. The diverted plasmas have a nominal major radius of 167 cm, minor radius of 55 cm, and elongation of 2. The pump limiters have a radial stroke of 50 cm and are compatible with a variety of plasma cross-sections from full size highly elongated dee-shaped plasmas (R_o = 167 cm, a = 67 cm, K = 2) to circular plasmas of reduced minor and major radii.

45877 Surface microanalysis of C+SiC coating on limiter/armor exposed in Doublet III. Hirohata, Y.; Mohri, M.; Yamashina, T. (Hokkaido Univ., Sapporo (Japan). Dept. of Nuclear Engineering); Trester, P.W.; Hopkins, G.R.; Hino, T. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 477-480(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Limiter/armor tiles coated with a new C+SiC alloy have been tested in Doublet III. Sections of an exposed tile have been examined with surface microanalysis for compositional changes and impurity concentrations. The major impurity elements observed were Ti, O, Ni, Cr, Al, and Fe, with minor amounts of Cl, Ca, and S. Arc track regions showed low Ti, Ni, and Fe, otherwise the distribution was fairly uniform. Depth profiling of impurities showed impurity diffusion into the coating up to depths ranging from 1000 to 5000 nm.

45878 Effect of a single blade limiter on energetic neutral beam particles in Doublet III. Petrie, T.W.; Armentrout, C.; Burrell, K.H.; Hino, T.; Kahn, C.; Kim, J.; Lohr, J.; Rottler, L.; Schissel, D.; St John, H. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 487-492(Dec 1984). (CONF-840520—). Contract AC03-84ER51044.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Energetic beam ion collisions with the main limiter can be a significant power loss process under certain operating conditions in Doublet III. Futhermore, these collisions may cause measurable damage to the limiter itself. Under low current and low toroidal field conditions (e.g., Isub(p) = 290 kA and Bsub(T) = 6.3 kG), 20-38% of the inferred absorbed beam power may be deposited directly on the ion drift side of the limiter by the beam ions. However, for higher plasma current and toroidal fields (e.g., Isub(p) = 480 kA and Bsub(t) = 15 kG), the fraction of inferred absorbed beam power deposited on the limiter is reduced to <10%. Monte Carlo code simulations show that this loss of beam power is primarily a result of the large poloidal and toroidal gyro-orbits of the energetic beam ions. Other factors which may enhance beam ion losses to the limiter are (1) large separation distances between the primary limiter and the (outboard) vacuum vessel wall, and (2) plasma density buildup near the plasma edge during high gas puff operation. In addition, our data suggests enhanced plasma density and recycling near the limiter. This localized density can cause appreciable premature ionizations of the incoming beam neutrals and thus reduce the effective plasma heating of the beamline which is immediately upcurrent of the limiter. The prematurely-ionized beam particles from this adjacent beamline are responsible for much of the damage to the ion drift side of the limiter. We have found that under certain operating conditions (1) the direct beam heating of the limiter is 50% greater and (2) the stored plasma energy is 10% less when the beamline immediately upcurrent of the limiter heats the plasma. Thus, the relative positions of the limiters to the beamlines are important in designing future tokamaks.

45879 Graphite limiter damage due to runaway electrons and abrupt Isub(p) termination in Doublet III. Nishikawa, M. (Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)); Yokomizo, H.; Kitsunezaki, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki); McKelvey, T.E.; Taylor, T.S.; Doll, D.; Brook, N.; Seraydarian, R. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 493-499(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Two kinds of plasma-related damage, spotty damage and wide area damage, have been photographically recognized on the TiC-coated surface of the new graphite primary limiter in Doublet III. TV and infrared-camera observations revealed the relationship of these damages to the plasma operations. The spotty damage was generated by a single runaway discharge. The runaway electron energy was deposited not only on the surface but also penetrated into the bulk graphite. Thermal analysis showed that runaway electron of 5-6 MeV penetrates into the limiter to approximately 1.5-2.0 cm. Wide area damage was caused by one or more successive discharges which exhibited rapid termination of the plasma current. In this case, the electron energy was deposited only on the limiter surface.

45880 Evaluation of limiter configurations in ZT-40M. Downing, J.N.; Buchenauer, C.J.; Ingraham, J.C.; Krakowski, R.A.; Phillips, J.A.; Watt, R.G. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **128/129**: 517-523(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Three limiter configurations were evaluated in the reversed-field pinch, ZT-40M. A bare graphite mushroom-shaped probe located in a pump port measured changes in the energy flux profiles resulting from three different limiter configurations. The first configuration was a graphite segmented poloidal ring limiter located 90° toroidally upstream from the mushroom probe, and it protruded into the plasma chamber proportional 0.95 cm beyond the bellows. The second configuration consisted of three graphite tiles which were positioned in the bottom of the convolution section immediately upstream from the mushroom probe. These tiles were electrically floating with respect to the metal liner and protruded radially inwards proportional 1.27 cm beyond the bellows. For the third configuration four graphite tiles were placed on each side of the pump port section where the mushroom probe was located. These tiles extended 25 cm in both toroidal directions from the pump port section and protruded proportional 0.95 cm into the plasma region. These tiles were also electrically floating. The introduction of the poloidal ring limiter resulted in the mushroom probe absorbing 28% less energy at the major radial position where the tip of the mushroom was even with the shadow of the liner bellows. The tile limiters produced an additional, but small, reduction in the energy absorbed at this location. The tiles produced an increase in the plasma resistance and radiation late in the discharge. Significant amounts of arcing occurred between the tiles and the liner.

45881 High power ohmic heating experiments with graphite wall protection in OHTE. Jackson, G.; Carlstrom, T.; Curwen, B.; Goforth, R.; Graumann, D.; La Haye, R.; Register, D.; Schaffer, M.; Tamano, T.; Taylor, P. (GA Technologies, Inc., San Diego, CA (USA); Phillips Petroleum Co., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 531-533(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

High power ohmically heated toroidal pinch experiments have been performed in the OHTE device. With graphite wall protection, plasma currents of up to 500 kA and high β plasmas with ntau proportional 10^{11} cm^{-3} s have been achieved. In this paper we will describe problems associated with wall heating for high power ohmically heated plasmas, protection of the OHTE metal vacuum liner, and the results of plasma operation with graphite covering one-third of the wall area.

45882 Influence of impurities on the high-temperature sputtering yield of graphite. Roth, J.; Bohdansky, J. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)); Roberto, J.B. (Oak Ridge National Lab., TN (USA)). *Journal of Nuclear Materials;* **128/129**: 534-539(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The influence of near-surface impurities on the enhanced sputtering of graphite near 600°C and above 1000°C has been investigated under various doping conditions. The chemical sputtering yield of methane molecules for 2 keV D^+ ions on graphite at 600°C has been determined for several coverages of Si, Fe, Ni, Ti, Mo, and Au. Graphite samples were pre-deposited with proportional 500 A of a given impurity, and weight loss was monitored in-situ using a vacuum balance while sputtering through the deposited layer. Small amounts of impurities remaining on the surface after prolonged sputtering reduced chemical erosion by 30-50%. The radiation-enhanced sublimation of graphite observed for energetic ion bombardment above 1000°C was investigated during 50 keV Ar sputtering and simultaneous Ti evaporation. For very low surface concentrations of Ti, graphite sputtering increased while for concentrations above 10 at% the yields were significantly reduced. A graphite sample containing 4 at% bulk Si was also investigated and showed greatly reduced chemical erosion at 600°C but no reduction in radiation-enhanced sublimation at 1500°C due to surface enrichment and depletion of Si for the low- and high-temperature irradiation, respectively.

45883 Calculation of molybdenum sputtering from the limiter in Alcator C. Lipschultz, B.; La Bombard, B.; Marmar, E.S.; Pickrell, M.M.; Rice, J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Journal of Nuclear Materials;* **128/129**: 555-558(Dec 1984). (CONF-840520—). Contract AC02-78ET51013.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A simple one-dimensional model for sputtering from the surface of a molybdenum limiter has been developed. Sources of sputtering included in this model are due to thermal ions and the subsequent self-sputtering that follows. The resultant molybdenum source rates match those calculated based on molybdenum line emission data from the main plasma coupled with an anomalous impurity diffusion coefficient. A review of the source rate dependence on plasma parameters is also included.

45884 Sputtering properties of copper-lithium alloys at reactor-level temperatures and surface erosion rates. Krauss, A.R.; Gruen, D.M.; Lam, N.Q. (Argonne National Lab., IL (USA). Materials Science Div.); De Wald, A.B. (Georgia Inst. of Tech., Atlanta (USA)). *Journal of Nuclear Materials;* **128/129**: 570-576(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Previous experiments on copper-lithium alloys at temperatures up to 250°C and with erosion rates of 0.01-0.1 monolayer/s for 3 keV Ar^+ bombardment have shown that in the electric and magnetic field environment of a magnetic-confinement fusion reactor, it is possible to maintain a lithium overlayer which will significantly reduce the copper erosion rate. We have extended these experiments to the reactor-relevant regime of 350-400°C, with erosion rates approaching one monolayer/s (1.5 keV Ar^+ bombardment at 2.1 x 10^{14}/cm^2 s., normal incidence). By comparison with the lower-flux experiments, it is found that radiation damage effects start to dominate both the surface concentration and depth profile of the lithium. The subsurface region of enhanced lithium concentration is broadened, while the surface concentration is not depleted as rapidly per incident ion as in the low-flux case. The time-dependent lithium depth profile is calculated using a computer code developed at Argonne which includes both Gibbsian segregation and radiation-induced effects. The experimental results are compared with these calculations. It is found that the sputtering behavior of the copper-lithium alloys is highly dependent on the mass and energy spectrum of the incident particles, the sample temperature, subsurface structure, and the partial sputtering yields of the alloy components.

45885 Unipolar arc model. Schwirzke, F. (Naval Postgraduate School, Monterey, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 609-612(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Unipolar arcing occurs when a plasma of sufficiently high electron temperature interacts with a surface. Without any external voltage applied, many electrical micro-arcs burn between the surface and the plasma driven by local variations of the sheath potential with the wall acting as both the cathode and anode. Unipolar arcing represents the most damaging and non-uniform plasma-surface interaction process since the energy available in the plasma

concentrates towards the cathode spots. This causes cratering of the surface. The modified unipolar arc model takes into account the increase of plasma density due to ionization of neutrals released from the cathode spot. The local increase of the plasma pressure above the cathode spot leads to an electric field configuration which drives the arc current and also facilitates the electron return current flow to the surface. The return current area surrounding the arc is by orders of magnitude smaller than previously estimated. The sheath potential in this area approaches zero and the electron return current is given by the electron saturation current. The model also explains the retrograde arc motion observed in Tokamaks.

45886 **Hydrogen trapping, diffusion and recombination in austenitic stainless steels.** Langley, R.A. (Oak Ridge National Lab., TN (USA). Fusion Energy Div.). *Journal of Nuclear Materials;* **128/129**: 622-628(Dec 1984). (CONF-840520—). Contract AC05-84OR21400.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Trapping, diffusion, and recombination of hydrogen in austenitic stainless steels are reviewed. It is suggested that since all of these processes are strongly interdependent and since the measured recombination rates are found to vary four orders of magnitude at any temperature, the data analysis techniques used to date are insufficient. At wo-region diffusion model with surface recombination is proposed in which the surface layer is characterized by a smaller diffusion coefficient than the bulk.

45887 **Low-Z C+SiC alloy coating material for plasma interface applications.** Hopkins, G.R.; Trester, P.W.; Kaae, J.L. (GA Technologies, Inc., San Diego, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 802-811(Dec 1984). (CONF-840520—). Contract AC03-84ER53158.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A new C + SiC alloy material has been developed for fusion in-vessel components. Limiter/armor tiles coated with this material have been tested for over 16000 plasma shots during routine operation of Doublet III. The performance has been excellent. Simulation tests have shown this C + SiC alloy to be highly resistant to chemical sputtering below 1000°C and to be resistant to damage from thermal shocks. The low Z characteristic is advantageous in reducing plasma energy loss from impurities.

45888 **Correlation of experimental and theoretical results for vaporization by simulated disruption.** Croessmann, C.D.; Kulcinski, G.L. (Wisconsin Univ., Madison (USA). Fusion Engineering Program); Whitley, J.B. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Nuclear Materials;* **128/129**: 816-821(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Samples of Al, 1100 Al, SS 304, Ni, Mo, and TZM were subjected to a simulated plasma disruption produced by a 25 kV electron beam for times of 100 to 500 ms with an energy flux of 0.5 to 7.0 kJ/cm^2. The net vaporized thickness was measured as a function of absorbed energy density for experimental results and predicted by theoretical models. Agreement was found for the threshold energy density for vaporization and the functional dependence of vaporization on energy density over a wide range of parameters. The usefulness of electron beam experiments to verify and guide the development of vaporization models for high heat flux component design was shown.

45889 **Characterization of impurities deposited on the PDX graphite rail limiter.** Doyle, B.L.; Wampler, W.R. (Sandia National Labs., Albuquerque, NM (USA)); Dylla, H.F.; Owens, D.K.; Ulrickson, M.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **128/129**: 955-959(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The surface contamination of a graphite rail limiter recently removed from the PDX tokamak has been characterized using ion-beam, electron-beam and X-ray analyses. The major impurities detected were Ti and Fe, with the Ti present in the form of a carbide. The distribution of these elements indicate that the erosion and deposition processes balance at a distance one cm from the apex of this limiter (the point of contact with the plasma) for Ti and at about two cm for Fe. The importance of TiC formation on the conditioning process is discussed.

45890 **Tritium inventory and permeation in TFTR.** Baskes, M.I.; Wilson, K.L. (Sandia National Labs., Livermore, CA (USA)); Brice, D.K.; Doyle, B.L.; Wampler, W.R. (Sandia National Labs., Albuquerque, NM (USA)); Heifetz, D.B.; Dylla, H.F.; Cecchi, J.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **128/129**: 629-635(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

The control of tritium in TFTR has both important safety and environmental implications. Current modelling techniques allow realistic predictions of the tritium inventory in and permeation through in-torus components. The source of the tritium was computed using a three-dimensional description of the neutral particle flux on the TFTR vacuum vessel wall from the neutral transport code DEGAS, under plasma conditions modelled with the one-dimensional transport code BALDUR. The movable limiter (graphite) was modelled using an extension of the Local Mixing Model for hydrogen retention and isotope exchange. In particular, the calculations consider the inventory and recycling for the movable limiters (which are expected to experience transient temperatures up to 2000°C) as well as the bumper limiters and protective plates which will remain somewhat cooler. Transient effects in the bulk graphite limiter and in the stainless steel wall were modelled using the DIFFUSE code with materials parameters taken from the most recent literature. It appears that for the expected material properties, specifically the hydrogen recombination constant measured in a clean TFTR environment, and operating scenario, there will be essentially no tritium permeation through the stainless steel walls or bellows and less than 0.1 kCi of tritium inventory in the stainless steel first wall. The limiters may contain as much as 5 kCi of tritium.

45891 **Dynamical calculation of low energy hydrogen reflection.** Baskes, M.I. (Sandia National Labs., Livermore, CA (USA)). *Journal of Nuclear Materials;* **128/129**: 676-680(Dec 1984). (CONF-840520—).

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

A current critical question in plasma/first wall interactions is that of low energy (<100 eV) hydrogen reflection. Experiments in this energy regime are extremely difficult. Previous to this work, calculations have not been performed with an interaction potential of sufficient quality to simulate the chemical interactions which may dominate reflection at low energies. The Embedded Atom Method (EAM) has recently been developed to simulate such chemical interactions with a free surface. Using EAM the reflection coefficient for hydrogen on a clean (100) nickel surface has been calculated as a function of incident energy from 0.1 to 100 eV. At the high end of the range the reflection coefficient is similar to that predicted by TRIM, a binary collision model, but below 3 eV, EAM predicts considerably lower reflection than does TRIM. Additional calculations have been performed to investigate the effects of crystal orientation and angle of incidence. These results will have a significant effect on the predictions made by neutral gas codes such as DEGAS on the modelling of pump limiters and divertor ducts.

45892 **Effective penetration shield design for ICF reactors.** Sawan, M.E.; Vogelsang, W.F.; Sze, D.K. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). pp 675-684 of Proceedings of the sixth international conference on radiation shielding, 2. Tokai, Japan; Japan Atomic Energy Research Inst. (1983). (CONF-830538—Pt.2).

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

A shield design in which the inner surface is tapered along the direct line-of-sight from the ICF target is presented. This shield design was found to reduce the radiation effects in the final focusing magnets of HIBALL by three orders of magnitude compared to

the traditional untapered shield design. This design results also in reducing radiation streaming into the periodic transport system of HIBALL.

45893 **Multiframe holographic shadowgraphy and interferometry of laser target plasmas.** Busch, G.E.; Charatis, G. (KMS Fusion Inc., Ann Arbor, MI). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **348**: 650-657(1983). Contract AC08-82DP40152.

For purposes of characterizing and studying the formation and evolution of laser driven plasmas in fusion research, a method has been developed to optically probe the plasmas and produce a sequence of four or more holographic time resolved image frames at equivalent rates to 20 billion/sec. The plasma uv probe operates at 0.26 μm either in a shadowgraphic or interferometric mode. Electron density contours between $\sim 10^{19}$ and 10^{21} cm^{-3} are obtained from the interferograms. 6 references, 8 figures.

45894 **(PPPL-TRANS—127) Stability of tokamak magnetic configuration with a poloidal divertor.** Bazaeva, A.V.; Bykov, V.E.; Georgievskii, A.V.; Kaminskii, A.O.; Peletminskaya, V.G.; Pyatov, V.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.; AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). Feb 1979. Contract AC02-76CH03073. Translation of KhFTI 77-32, 1977. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017019.

This paper investigates instabilities in the preseparatrix region of a tokamak magnetic configuration with a poloidal divertor with respect to perturbations produced by various irregularities in the manufacturing of tokamak magnetic systems. A computer solution, a system of differential equations describing the behavior of a force line, showed that small perturbation amplitudes may be the cause of the stochastic instability of force lines in the preseparatrix region. This instability is responsible for a number of demands on the accuracy in the manufacturing of tokamak magnetic systems. In particular, the misalignment in the divertor ring must not be larger than 0.5°, its displacement must be less than $\Delta/R = 10^{-3}$ ($\Delta/R << 10^{-2}$). This study can be used in the design of large thermonuclear installations.

99 GENERAL AND MISCELLANEOUS

45895 **(DOE/MI—0006) Resource guide for Small Minority-Owned Energy Businesses. Volume 1. The resource guide.** (Argonne National Lab., IL (USA)). Aug 1985. Contract W-31-109-ENG-38. 130p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017005.

This resource guide has been developed to provide minority business entrepreneurs with a comprehensive framework which will assist them in evaluating the feasibility and viability of specific energy-oriented business options for both current and emerging technologies in the energy industry. It includes information which is applicable to situations within the residential, commercial, industrial, and transportation sectors of the energy industry and attempts to indicate specific levels of government participation, needed financial initiatives, and necessary regulatory adjustments within the dynamic energy environment.

45896 **(DOE/MI—0006-Vol.2) Resource guide for small minority-owned energy businesses. Volume 2. Appendixes.** (Argonne National Lab., IL (USA)). Aug 1985. Contract W-31-109-ENG-38. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017006.

The 18 appendices are: Business Incubators, State and Technical Assistance Centers and Federal Technical Information Centers Available to US Businesses, 1985, America's 50 High-Tech Highways, Regional Libraries in the Federal Depository Library Program, Publications of the Energy Information Administration, Field Offices of the Small Business Administration, Minority-Owned Banks and Savings & Loan Associations, Publications That Help the Minority Entrepreneur Sell to the Government, Office of Small and Disadvantaged Business Utilization, Small Business/Disadvantaged Business Contacts at DOE Headquarters and Government-Owned Contractor-Operated Facilities, Program Management Centers of the Department of Transportation, Business Service Centers of the General Services Administration, State Offices That Administer the Weatherization Assistance Program, State Energy Offices, State Energy Extension Services, Minority Business Development Centers, Organizations of Interest to Minority-Owned Energy Businesses, and Energy Directories.

45897 **(LA-UR—85-2740) Communicating across barriers at home and abroad.** McDonald, J.W. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850864—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015729.

From Forum 85; Helsingor, Denmark (26 Aug 1985).

This paper intends to catalyze the exchange of experience among technical communicators in meeting the challenge of communicating across a multitude of barriers: linguistic, disciplinary, cultural, political, intellectual, and emotional.

45898 **(SAND—84-0887) Generation of target line-of-sight angles for hardware-in-the-loop simulation of a terminally guided vehicle.** Greene, R.W. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1985. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016789.

Hardware-in-the-loop simulation of terminal guidance systems requires that the kinematic relationships between the target and the vehicle-mounted target sensor be reproduced accurately. To do this with the vehicle hardware mounted on a gimballed, fixed-base platform, either the platform must be oriented in response to the simulated target encounter geometry or the target must be movable. This report documents several alternate techniques for reproducing the desired line-of-sight angles that locate the target within the field of view of the target sensor.

45899 **Current Energy Patents: a current awareness journal.** Kinser, W.H. (ed.). *Current Energy Patents;* No. 85/1, vp(Jan 1985). (PB—85-902801; CEP—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $75.00 per volume (calendar) year.

This monthly current awareness journal provides abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. The journal includes all patents entered into the Energy Data Base. The literature is arranged by subject category and abstracts are provided. Indexes are included for the assignee, inventor, subject, and patent number. (WHK)

9901 Management

REFER ALSO TO CITATION(S) 45909

45900 **(CONF-8506147—1) Highway Construction Inspection Management using a microcomputer.** Chin, S.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014311.

From National conference on microcomputers in urban transportation; San Diego, CA, USA (17 Jun 1985).

This paper describes the operation of the Highway Construction Inspection Management Program (HCIMP). HCIMP is a microcomputer based data base management program which enables engineers to store, maintain, and update the quantities and progress of each contract pay item which has been incorporated into the construction project over the contract period. The user can retrieve or review desirable information easily and quickly. In addition, the program can generate a daily inspector report summary, cumulative contract item summary, costs overrun summary, costs underrun summary, and monthly summary expeditously and effortlessly.

45901 (DOE/PE/70267—T41) Energy, foresight, and strategy. Sargent, T.J. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-80PE70267. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016755.

Energy and National Security Series.

This introductory essay establishes the background for a series of seven separate essays which use dynamic economic theory to study aspects of the processes by which energy sources are discovered, priced and stored. (GHT)

45902 (DPSTQA—83-4-2-Rev.2) Savannah River Laboratory quality assurance manual. Revision 2. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1985. Contract AC09-76SR00001. 163p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85017041.

The SRL quality assurance program is a management activity that verifies that the results of our research and development are adequate for their intended use and that our facilities function properly. The program is based on Savannah River Quality Assurance Plan (DPW-82-111-2, Rev 0) as applied through Quality Assurance Procedures and Divisional Plans (following section). The AED policy states that "all activities shall be conducted to achieve a high quality of product and performance..." The policy contains 18 considerations to be applied "proportional to needs, based on the technical and professional judgment of responsible Du Pont employees." Quality is the responsibility of each individual and his line organization, as is safety. To ensure that quality is being considered for all SRL activities, all research programs are reviewed, and all facilities are assessed. These assessments and reviews are the nucleus of the Quality Assurance program.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 43754, 44086, 44484, 44754, 44866, 44871, 44949, 44991, 45725

45903 (AD-A—154377/6/XAB) Parallelized-point successive over-relaxation method on a multiple instruction multiple data stream computer. Memorandum report. Patel, N.R.; Sturek, W.B.; Jordan, H.F. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Nov 1984. 39p. (BRL-MR—3411). NTIS, PC A03/MF A01.

A parallelized-point rowwise successive over-relaxation (SOR) iterative algorithm is developed for the heterogeneous element processor (HEP) multiple-instruction-stream computer. The classical point SOR method is not easily vectorizable with rowwise ordering of the grid points, but it can be effectively parallelized on a multiple instruction stream machine without suffering in convergence rate. The details of the implementation, including restructuring of a serial FORTRAN program and techniques needed to exploit the parallel-processing architectural concept of the HEP, are presented. The parallelized algorithm is analyzed in detail. The lessons learned in this study are documented to provide guidelines for similar future coding since new approaches and restructuring techniques are required for programming a multiple-instruction machine, which are totally different than those required for programming an algorithm on a vector processor. To assess the capabilities of the parallelized algorithm, it was used to solve Laplace's equation on a rectangular field with Dirichlet boundary conditions. Computer run times are presented that indicate significant speed gain over a scalar version of the code. For a moderate-to-large-size problem, seventeen or more processes are required to make efficient use of the parallel-processing hardware.

45904 (AD-A—154507/8/XAB) Representation of knowledge in image understanding. Annual scientific report, 1 May 1983-30 April 1984. Spinelli, D.N. (Massachusetts Univ., Amherst (USA). Dept. of Computer and Information Science). Mar 1985. 20p. NTIS, PC A02/MF A01.

The author believes that understanding adaptation and knowledge representation is fundamental to make progress in image understanding by animal brains. He has been studying the anatomical structures and the temporal requirements that lead to adaptation. This report makes a brief excursion into some experiments that have been demonstrated in the past. Also discussed is the enormous complexity of the problem at hand, and it is concluded that only a method that allows the reading out of recognizable visual memories has any chance to make progress in this complex endeavor. Determined were some of the parameters that produce powerful adaptation and have methods that allow memory read-outs. A preliminary conclusion is that image understanding requires a learning principle that takes into account the nature of the information and not just temporal and/or spatial relationships. Animal brains possess extremely effective vision systems. Architectural and functional principles gained by studying them will certainly lead to new ideas for new computer architectures especially in the fields of machine vision, adaptation, and parallel computation.

45905 (ANL—84-51-Rev.1) Use of monitors in FORTRAN: a tutorial on the barrier, self-scheduling DO-loop, and askfor monitors. Revision 1. Lusk, E.L.; Overbeek, R.A. (Argonne National Lab., IL (USA)). Jun 1985. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017051.

A set of macro libraries has been developed that allows programmers to write portable FORTRAN code for multiprocessors. This document presents, in tutorial form, the macros used to implement three common synchronization patterns: self-scheduling DO-loops, barrier synchronization, and the askfor monitor.

45906 (ANL—84-84) Tutorial on the Warren abstract machine for computational logic. Gabriel, J.; Lindholm, T.; Lusk, E.L.; Overbeek, R.A. (Argonne National Lab., IL (USA)). Jun 1985. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016925.

Computational logic can roughly be defined as that branch of artifical intelligence that is based on logic. It includes logic programming, theorem-proving, rewrite-rule systems, and production-rule systems. Such fields are going through a truly interesting transition. It now is becoming apparent that performance improvements for computational logic systems could be as high as 3 to 5 orders or magnitude during the next 5 to 7 years. These improvements will come from three distinct sources: (1) The processors used in the commonly available computing systems will improve by a factor of 5 to 10. That is, commonly available, cheap processors will increase substantially in speed. (2) Multiprocessors featuring up to 1024 nodes will become widely available. Each node may contain 4 to 16 tightly coupled processors (on a shared memory). (3) Substantial speedups will occur due to improvements in the implementation of the basic algorithms. The last point is the focus of this document.

45907 (CONF-851042—1) Providing personal desktop computing recommendations. Coultis, D.W.; Gallo, M.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85007988.

From Association for Computing Machinery conference - the range of computing: mid-80's perspective; Denver, CO, USA (14 Oct 1985).

The increasing number of personal desktop computer users, coupled with rapidly changing personal desktop computer technology, has increased the demand for computing services. However, for many computing centers, budgets have not increased as rapidly as the demand for services. Providing personel desktop computing recommendations and encouraging users to follow them are effective means of meeting demands for computing services, even while operating within a constant or slowly growing budget. Providing personal desktop computing recommendations reduces evaluation costs, shifts the burden of evaluation, eases acquisition, encourages expertise, and expedites the repair of personal desktop computers. In this paper, we discuss issues associated with managing personal desktop computers, present the benefits of providing personal desktop computing recommendations, propose a process and suggestions for making these recommendations, and discuss our experiences with personal desktop computing recommendations at Argonne National Laboratory.

45908 **(CONF-8509140—1) Managing personal desktop computing at Argonne National Laboratory.** Coultis, D.W.; Gallo, M.A. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85014976.

From Conference of the ACM SIGUCCS user services "Pulling It All Together"; Toledo, OH, USA (30 Sep 1985).

The increasing number of personal desktop computer users, coupled with rapidly changing personal desktop computer technology, has increased the demand for computing services at many computing centers. However, for many computing centers, budgets have not increased as rapidly as the demand for services. These centers can use several methods to help balance increasing demands and fixed resources. Providing personal desktop computing recommendations and encouraging users to follow them are effective means of meeting demands for computing services, even while operating within a constant or slowly growing budget. Providing personal desktop computing recommendations reduces evaluation costs, shifts the burden of evaluating personal desktop computing products, and encourages expertise. Making the acquisition of personal desktop computer hardware and software easier benefits the user as well as the computing center. Users receive evaluated products for which they can obtain assistance from the computing center, while computing centers encourage the use of recommended products. Computing centers can also encourage and nurture personal desktop computing users groups. These users groups identify areas of need, participate in the evaluation process, and help reduce the demand for computing center resources. This paper discusses issues associated with managing personal desktop computing, proposes guidelines for instituting a management program, and discusses our experiences with managing personal desktop computing at Argonne National Laboratory.

45909 **(DOE/ER—0240) Summaries of the FY 1984 and FY 1985 Applied Mathematical Sciences research program.** (USDOE Office of Energy Research, Washington, DC. Scientific Computing Staff). Jul 1985. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016240.

The purpose of this report is to provide a convenient compilation of summaries of the individual research projects that constitute the Applied Mathematical Science research subprogram managed by the Director, Scientific Computing Staff, Office of the Director of Energy Research, Department of Energy. This new office, organized in 1984, consists of the applied mathematical sciences research activity formerly under the Division of Engineering, Mathematical Geosciences, Office of Basic Energy Science, Office of Energy Research, and the management of the expanded National Magnetic Fusion Energy Computer Network formerly under the Office of Magnetic Fusion Energy.

45910 **(DOE/ER/10822—3) Short report and proposal for three-month extension on design, evaluation, and use of high performance computer systems.** Kuck, D.J.; Lawrie, D. (Illinois Univ., Urbana (USA). Dept. of Computer Science). 4 Nov 1983. Contract AC02-81ER10822. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016730.

In the last year, the authors studied many problems regarding design, evaluation, and use of high-performance computer systems: (1) The authors carried out extensive analysis of benchmarks as well as complete programs on our Parafrase system. (2) The authors studied problems of supercomputer design including memory hierarchies, interconnection networks, synchronization problems, control mechanisms, models of computation, organization and access of complicated data structures, and designing high-performance systems with off-the-shelf components. (3) The authors worked on the definition and design of simulators and compilers for high-performance machines. (4) Realizing that automatic vectorization and restructuring of sequential programs does not always produce maximum speedup, the authors developed new algorithms that are used infrequently in well-known programs. These algorithms achieve significant speedups and are numerically stable at the same time.

45911 **(ECN—161) Determination of calibration equations by means of the generalized least squares method.** Zijp, W.L. (Netherlands Energy Research Foundation, Petten). Dec 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702039.

For the determination of two-dimensional calibration curves (e.g. in tank calibration procedures) or of three dimensional calibration equations (e.g. for the calibration of NDA equipment for enrichment measurements) one performs measurements under well chosen conditions, where all observables of interest (inclusive the values of the standard material) are subject to measurement uncertainties. Moreover correlations in several measurements may occur. This document describes the mathematical-statistical approach to determine the values of the model parameters and their covariance matrix, which fit best to the mathematical model for the calibration equation. The formulae are based on the method of generalized least squares where the term generalized implies that non-linear equations in the unknown parameters and also covariance matrices of the measurement data of the calibration can be taken into account. In the general case an iteration procedure is required. No iteration is required when the model is linear in the parameters and the covariance matrices for the measurements of co-ordinates of the calibration points are proportional to each other.

45912 **(FNAL-TM—1323) Isolated data acquisition system for high voltage applications.** Waitz, A.; Donaldson, A. (Fermi National Accelerator Lab., Batavia, IL (USA); Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—247). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016984.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This report describes the design and operation of a microcomputer controlled system for acquisition of both analog and binary data within the high voltage stages of a linac modulator. The system is comprised of a microprocessor Controller which communicates with the remote data Acquisition circuits via an optical bus. The bus, which uses a 1 MHz Manchester II format, is configured as a loop, starting at the Controller, daisy-chaining the remote cards and terminating back at the Controller. Upon receiving a linac timing pulse, the Controller sends addressed commands to the individual remote cards and receives data back. It then passes this data to the linac control system through a Multibus connection. Each remote circuit can return 16 binary sense and 7 (12 bit) analog parameters within 270 us. This speed is possible because of a pipelined design where one word is transmitted while another is being converted. A data conversion cycle is initiated when a remote data acquisition card receives the proper command and address from the controller.

45913 **(IPP—6/236) Computing complex eigenvalues of large non-hermitian matrices.** Kerner, W.; Lerbinger, K.; Steuerwald, J. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85751878.

The generalized eigenvalue problem Ax = lambdaBx with a non-symmetric matrix A is solved by means of inverse vector iteration. The algorithm makes use of the band structure of the matrices thus allowing quite large dimensions (d <= 3742). In the application all complex eigenvalues for the resistive Alfven modes are successively computed.

45914 **(KFK—3860) FORTRAN-77 version of the Karlsruhe program system KAPROS.** Moritz, N. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Feb 1985. 309p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE85751905.

The FORTRAN-77 KAPROS-kernel includes some major changes compared with the version, which is described in the KfK-report 2254. The changes are documented in this report from the point of view of the system-programmer. This report is meant to be a supplement to the KfK-report 2254, assuming that the reader of

this report is familiar with the KfK-report 2254. He also should be familiar with the IBM operating system MVS SP1.3.2 and the usual terms of data processing.

45915 **(LA-UR—85-2409) Learning styles and embedded training: a case study.** Stoddard, M.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-860209—1). NTIS, PC A02. File Number DE85015398.

From 27. conference of the Association for Development of Computer Based Instructional Systems; New Orleans, LA, USA (3 Feb 1986).

The purpose of this paper is to describe user behavior with fixed-format and context-sensitive help that has been implemented on a personnel information system at Los Alamos National Laboratory and to suggest that user learning style is a key determinant for the design of embedded training.

45916 **(LA-UR—85-2479) Three-dimensional free Lagrangian hydrodynamics.** Trease, H.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-8504150—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015707.

From International conference on fluid dynamics; Reading, England (1 Apr 1985).

The purpose of the discussion is to describe the development of a 3-D free Lagrangian hyrodynamics algorithm. The 3-D algorithm is an outgrowth of an earlier 2-D free Lagrange model. Only the more pertinent issues of the free Lagrange algorithm are presented. A complete production code is being developed to support the free Lagrange algorithm described. 4 refs.

45917 **(LBL—16993-Rev.) Lectures on probability and statistics. Revision.** Yost, G.P. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 151p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85016571.

These notes are based on a set of statistics lectures delivered at Imperial College to the first-year postgraduate students in High Energy Physics. They are designed for the professional experimental scientist. They begin with the fundamentals of probability theory, in which one makes statements about the set of possible outcomes of an experiment, based upon a complete a priori understanding of the experiment. For example, in a roll of a set of (fair) dice, one understands a priori that any given side of each die is equally likely to turn up. From that, we can calculate the probabilty of any specified outcome. They finish with the inverse problem, statistics. Here, one begins with a set of actual data (e.g., the outcomes of a number of rolls of the dice), and attempts to make inferences about the state of nature which gave those data (e.g., the likelihood of seeing any given side of any given die turn up). This is a much more difficult problem, of course, and one's solutions often turn out to be unsatisfactory in one respect or another. Hopefully, the reader will come away from these notes with a feel for some of the problems and uncertainties involved. Although there are standard approaches, most of the time there is no cut and dried "best" solution - "best" according to every criterion.

45918 **(LBL—19230) Data model and the design of a scientific database management system.** Chan, P.S. (Lawrence Berkeley Lab., CA (USA)). Feb 1985. Contract AC03-76SF00098. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016486.

A data model consisting of two levels is discussed in this paper. The logical level integrates the n-dimensional concept with the graph concept into a single data structure. To satisfy the requirement of time variation of data definitions, the idea of effectivity is incorporated. At the physical level, the data model partitions the n-dimensional data space into subspaces which can be accessed randomly and processed in parallel. 17 refs., 4 figs.

45919 **(LBL-PUB—3052) Software tools programmer's manual.** Breckon, T.; Jacobson, V.; Leres, C.; Paxson, V.; Travis, N. (Lawrence Berkeley Lab., CA (USA)). Apr 1985. Contract AC03-76SF00098. 777p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85016421.

This manual covers programming tools available at the Lawrence Berkeley Laboratory. (GHT)

45920 **(ORNL/TM—9656) Navy aircraft support data systems study: ECAMS/NALCOMIS integration feasibility and procedure.** Carr, K.R. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 78p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016977.

A study was done to identify and evaluate options for providing major improvements, extensions, and integration of essential automatic data processing equipment. This work is part of a long-term (several years duration) project in which Oak Ridge National Laboratory (ORNL) is establishing a "center of excellence" in support of the Department of the Navy in the Shipboard Nontactical Automated Data Processing Program. The program involves Honeywell DPS-6 minicomputers, Digital Equipment Corporation PDP-11 minicomputers, Zenith personal computers, and magnetic tape readers for surface processing of in-flight recorded data. The central issue addressed in this report is hardware and software options for interfacing the tape readers to the Honeywell equipment. (Even though the tape readers may eventually be replaced, the interface is needed at least for a few years transition period and probably would be used by the replacement system). Three leading candidate methods for providing the required interface were identified and analyzed. Variations of one method were also analyzed. A system-by-system comparison of the options is given in seven key areas: data transfer speed, data transmission distance capabilities, adaptability for processing classified data, flexibility and/or expandability, space required, logistics, and cost.

45921 **(UCID—20467) GRAFL-II: user oriented science graphics.** McNamara, B.; Willmann, P.A. (Lawrence Livermore National Lab., CA (USA)). 18 Jun 1985. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017147.

GRAFL-II is a small set of plotting routines able to produce 95% of the 2-dimensional figures and plots in the scientific literature from your Fortran code. The routines and their arguments have been designed to give extensive control over this type of picture with the minimum of fuss. We offer these 28 routines as a standard for the FORTRAN-based front end to any graphics library. The routines have been implemented on the MFECC computers to run the GRAFLIB and TV80LIB systems developed at Livermore. Although some of the coding uses low-level GRAFCORE routines it is sufficiently well commented to be easily modified or rewritten to drive other graphics libraries and enable codes to be transported more easily. A partial translation to drive the CERN graphics system has been made for use at the International Centre for Theoretical Physics, Trieste.

45922 **(UCRL—89640) Parallel P-code for Parallel Pascal and other high level languages.** Bruner, J.D.; Reeves, A.P. (Lawrence Livermore National Lab., CA (USA); Cornell Univ., Ithaca, NY (USA). School of Electrical Engineering). 21 Jul 1983. Contract W-7405-ENG-48. 6p. (CONF-8308190—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016097.

From 12. IEEE international conference on parallel processing; Bellaire, MI, USA (21 Aug 1983).

Parallel P-code is an intermediate compiler language for parallel processors. It was originally designed as part of a Parallel Pascal compiler for NASA's Massively Parallel Processor (MPP). However, it should also be suitable for a wide variety of high level languages and parallel architectures. Parallel P-code is based on a P-code language for serial processors; this paper describes the extensions which were necessary for the parallel environment.

45923 **Cross-validation of regression models.** Picard, R.R.; Cook, R.D. (Los Alamos National Lab., NM). *Journal of the American Statistical Association;* 79: No. 387, 575-583(Sep 1984).

A methodology for assessment of the predictive ability of regression models is presented. Attention is given to models obtained via subset selection procedures, which are extremely difficult to evaluate by standard techniques. Cross-validatory assessments of

predictive ability are obtained and their use illustrated in examples. 28 references.

45924 **Piecewise data flow architecture: architectural concepts.** Requa, J.E.; Mcgraw, J.R. (Lawrence Livermore National Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Computers;* 5: 425-438(May 1983).

This paper presents the design and a brief analysis of the piecewise data flow computer (PDF), an architecture proposed for very high-performance computing. PDE is a heterogeneous multiprocessor system having both SIMD and MIMD characteristics. Each computation is translated into a control flow graph in which each node contains a basic block of instructions. Concurrency can be exploited in three different ways: simultaneous execution of independent basic blocks, simultaneous execution of independent instructions within a basic block, and intrinsic array operations. This program representation is amenable to traditional languages (e.g., FORTRAN) because almost all optimizing compilers use basic blocks as their internal representation. New functional languages should be able to exploit this architecture even more easily. The most significant aspects of the PDF architecture concern scheduling basic blocks for execution, allocating registers to intermediate results, and assigning instructions to processors. 22 references.

9903 Information Handling

REFER ALSO TO CITATION(S) 43618

45925 **(DOE/NBM—5017027) EPIC/JANUS user's guide.** (USDOE Energy Information Administration, Washington, DC). Aug 1985. 221p. NTIS, PC A10/MF A01; 1 - GPO; GPO Dep. File Number DE85017027.

EPIC/JANUS, the Energy Information Administration's (EIA) Publication and Interactive Composition System, is a software system that allows text, tables, and graphics to be combined interactively in a single document. It automates the entire process of composition and production of camera-ready copy. EPIC is a machine-independent document management and translation system developed by EIA. JANUS is an interactive document composition system which actually formats and typesets a document.

45926 (EGG/10282—1057, pp 18.1-18.24) **Data representation: a historical perspective.** Smith, D.B. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The evolution of data presentation methods within the Aerial Measurements Operations is traced through the history of that organization. Data described is primarily three-dimensional, with some reference to one-, two-, and other multidimensional representations. Throughput and ease of implementation for the various and popular methods of representing data in the near future are discussed.

45927 **(K/CSD/INF—85-6) Modeling network data structures in relational-like data base management systems.** Scott, G.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1985. Contract AC05-84OT21400. 15p. (CONF-8509135—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015803.

From 1022/1032 users conference; Boston, MA, USA (22 Sep 1985).

This paper describes the implementation of a database within the System 1022 environment that successfully models a network data structure. Issues and problems relative to the representation of "many-to-many" relationships among data types in "relational-like" structures are discussed along with alternative solutions. Analysis procedures are described which led to the employment of a "special" System 1022 file that simulates the role of "junction" records in networks. A System 1022 database to assist in the management of CAD/CAM system resources has been developed at Martin Marietta Energy Systems utilizing this concept and is used as a practical example of this approach to data representation.

45928 **(LA-UR—85-2329) Logical and physical database design within a full-text environment.** Michelsen, C.D.; Shafer, D.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-850295—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015683.

From 2. IEEE international conference on data engineering; Los Angeles, CA, USA (4 Feb 1985).

This paper describes the problems and solutions encountered in the design of logical and physical data bases within a full-text environment. A full-text environment can be defined as data bases that store both citation information as well as actual document text. The problems/solutions encountered were a result of the necessity to integrate distinct physical data bases into a single logical data base without the assistance of a Data Base Management System that is capable of physical data base integration.

45929 **(SAND—84-7154) SABIRS: user reference and system documentation.** Flaming, R.M.; Bemesderfer, J. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1985. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016801.

SABIRS is an acronym for Sandia Abbreviated Bibliographic Information Retrieval System. This document is both a reference for users and system documentation which would permit a simple installation in a small or medium sized library on virtually any computer system.

45930 **Nuclear Fuel Cycle: a current awareness bulletin.** McLaren, L.H. (ed.). *Nuclear Fuel Cycle;* No. 85/1, vp(15 Jan 1985). (PB—85-913401; DOE/NFC—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

Nuclear Fuel Cycle announces on a semimonthly basis the current worldwide information available on all aspects of fuel cycle except in-reactor properties and fuel performance and the management of radioactive wastes.

45931 **Radioactive Waste Management: a current awareness bulletin.** McLaren, L.H. (ed.). *Radioactive Waste Management (Oak Ridge, Tennessee);* No. 85/1, vp(15 Jan 1985). (PB—85-902901; DOE/RWM—85/1).

Available from National Technical Information Service, Springfield, VA 22161 on a subscription basis at $40.00 per volume (calendar) year.

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Qualifier
Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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AC04-76DP00613	Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.	
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AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
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	Sandia National Labs., Albuquerque, NM (USA)	
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	Intersol Power Corp., Lakewood, CO (USA)	
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	Lockheed Missiles and Space Co., Palo Alto, CA (USA)	
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	Sandia National Labs., Albuquerque, NM (USA)	
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	10:44692	SAND—85-0839C
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AC07-76ID01570	EG and G Idaho, Inc., Idaho Falls (USA)	
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AC07-82ID12422	Signal UOP, Inc., Des Plaines, IL (USA). Research Center	
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AC08-82DP40152	KMS Fusion, Inc., Ann Arbor, Michigan 48106	
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	Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering and Health Physics	
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AC18-83FC10601	Texas A and M Univ., College Station (USA). Kinetics, Catalysis, and Reaction Engineering Lab.	
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AC18-84FC10614	Brigham Young Univ., Provo, UT (USA). Combustion Lab.	
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AC22-78ET00241	United Technologies Corp., East Hartford, CT (USA). Research Center	
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AC79-83BP12745	Fish Management Consultants, Olympia, WA (USA)	
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	10:44003	JPL—5101-66
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AI01-81FE00016	Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.	
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AI05-83OR21363	National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.	
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AI79-83BP17463	Bureau of Reclamation, Boise, ID (USA). Pacific Northwest Region	
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AI79-83BP39461	Yakima Indian Nation, WA (USA). Fisheries Resource Management	
	10:45189	DOE/BP—39461-1
AI79-83BP39642	National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.	
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AI79-83BP39643	National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.	
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AI79-83BP39644	National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.	
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AI79-84BP12149	Washington Dept. of Game, Olympia (USA)	
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	Fish and Wildlife Service, Portland, OR (USA)	
	10:43965	DOE/BP—369
AI79-84BP12660	Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)	
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AI79-84BP13099	BioSonics, Inc., Seattle, WA (USA)	
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AI79-84BP16687	Montana Dept. of Fish, Wildlife and Parks, Kalispell (USA)	
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AI79-84BP18968	Fish and Wildlife Service, Boise, ID (USA). Office of Ecological Services	
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AP07-79ID00019	Department of Nuclear Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 0	
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AS03-81ER40004	Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.	
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AS04-78AL04266	New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Metallurgical and Materials Engineering	
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AS05-76ER03065	Duke Univ., Durham, NC (USA). Dept. of Physics	
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AS05-76ER03106	Florida Univ., Gainesville (USA). Dept. of Chemistry	
	10:44834	DOE/ER/03106—86
AS05-76ER03346	Georgia Inst. of Tech., Atlanta (USA)	
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AS05-77ER05399	Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry	
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AS05-77ER05563	**Texas A and M Univ., College Station (USA). Dept. of Chemistry**	
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AS05-78ER05861	**Virginia Univ., Charlottesville (USA). Dept. of Physics**	
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AS05-78ER05940	**Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies**	
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AS05-78EV05855	**Florida State Univ., Tallahassee**	
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AS05-80ER10713	**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics**	
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	10:45475	DOE/ER/10713—4
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AS05-80ER10745	**Houston Univ., TX (USA). Dept. of Chemistry**	
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AS05-81EV10586	**Maryland Univ., Baltimore (USA)**	
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AS05-82ER12061	**Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Physics**	
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AS05-82ER12098	**Kentucky Univ., Lexington (USA). Dept. of Metallurgical Engineering and Materials Science**	
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AS05-82ER53134	**Department of Physics, Auburn University, Auburn, Alabama 36849**	
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AS05-83ER60158	**Maryland Univ., Baltimore (USA). School of Medicine**	
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AS07-76ID01523	**Pennsylvania State Univ., University Park (USA). Dept. of Mechanical Engineering**	
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AS07-77ET28407	**Idaho Dept. of Water Resources, Boise (USA)**	
	10:44109	DOE/ET/28407—T6
AS07-80ID12172	**Oklahoma Geological Survey, Norman (USA)**	
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AS09-76ER00854	**Georgia Univ., Athens (USA). Dept. of Chemistry**	
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AS09-76EV00637	**Univ. of Georgia College of Agriculture Experiment Stations, Tifton**	
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AS19-80BC10321	**University of Southern Mississippi, Hattiesburg (USA). Dept. of Polymer Science**	
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AT03-84ER52104	**University of California, Los Angeles, School of Engineering and Applied Science, Los Angeles, Calif**	
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FC01-80ET14914	**Union Rheinische Braunkohlen Kraftstoff A.G., Wesseling/Koeln (Germany, F.R.)**	
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FC01-84CE40699	**University City Science Center, Philadelphia, PA (USA). Center for Energy Management and Industrial Technology**	
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FC03-80SF11504	**Energy Materials Research Co., Berkeley, CA (USA)**	
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FC03-83FE60149	**USDOE Morgantown Energy Technology Center, WV**	
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FC05-77ET10069	**Exxon Research and Engineering Co., Annandale, NJ (USA)**	
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FC07-79ID12026	**Wyoming Univ., Laramie (USA). Dept. of Geology and Geophysics**	
	10:44110	DOE/ID/12026—T13
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FC07-83ID12430	**Connecticut Univ., Storrs (USA). Dept. of Chemical Engineering**	
	10:44741	DOE/ID/12430—T1
FC08-85DP40200	**Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 1**	
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FC21-83FE60177	**Western Research Inst., Laramie, WY (USA)**	
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FG01-78EV06660	**Georgetown Univ., Washington, DC (USA)**	
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FG01-79IR10022	**Durbin Associates, Princeton, NJ (USA)**	
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FG01-80CS24428	**Massachusetts Executive Office of Energy Resources, Boston (USA)**	
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FG01-81AF20001	**Palm Beach Junior Coll. Foundation, Inc., Lake Worth, FL (USA)**	
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FG01-82CE15128	**Ply International, Inc., Wimberley, TX (USA)**	
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FG01-82EP14018	**Center for Strategic and International Studies, Washington, DC (USA)**	
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FG01-82PE70399	**Woodrow Wilson International Center for Scholars, Washington, DC (USA)**	
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FG01-84EI19684	**Rhode Island State Fuel Allocation Office, Providence (USA)**	
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FG02-79CS30300	**NAHB Research Foundation, Inc., Rockville, MD (USA)**	
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FG02-83CH10146	**Michigan Energy and Resource Research Association, Detroit (USA)**	
	10:44464	DOE/CH/10146—1
FG02-84CH10211	**Tuskegee Inst., AL (USA). Carver Research Foundation**	
	10:43917	DOE/CH/10211—4
FG02-84ER45116	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering**	
	10:44599	DOE/ER/45116—6
FG02-84ER45144	**Chicago Univ., IL (USA)**	
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FG03-84ER45108	**Institute for Theoretical Physics, University of California at Santa Barbara, Santa Barbara, Califor**	
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FG04-82ER60088	**New Mexico Inst. of Mining and Technology, Socorro (USA)**	
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FG05-77ET20153	**Georgia Inst. of Tech., Atlanta (USA). School of Geophysical Sciences**	
	10:43974	DOE/ET/20153—80/1
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FG05-79IR10295	**American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center**	
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FG05-80ET53088	**Texas Univ., Austin (USA). Inst. for Fusion Studies**	
	10:45779	DOE/ET/53088—172
FG05-83OR21389	**Weston (Roy F.), Inc., West Chester, PA (USA)**	
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FG05-84ER13272	**Maryland Univ., College Park (USA). Dept. of Electrical Engineering**	
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FG05-84ER45071	**Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742**	
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FG05-84ER45135	**Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy**	
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FG06-84ER45121	**Boeing Co., Seattle, WA (USA)**	
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FG18-79ET14692	**Minnesota Dept. of Natural Resources, St. Paul (USA). Div. of Minerals**	
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FG22-82PC50800	**Illinois Univ., Urbana (USA). Dept. of Chemistry**	
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FG22-82PC50807	**Duke Univ., Durham, NC (USA). Dept. of Chemistry**	
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FG22-83PC60778	**SRI International, Menlo Park, CA (USA)**	
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FG22-84PC70778	**Catholic Univ. of America, Washington, DC. Dept. of Mechanical Engineering**	
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FG22-84PC70779	**Colorado Univ., Boulder (USA)**	
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FG22-84PC70794	**Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.**	
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FG22-84PC72268	**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research**	
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FG42-81R205273	**Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Mechanical Engineering**	
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FG42-81R205304	**Flynn (Joseph), Bliss, NY (USA)**	
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FG42-81R205321	**Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Engineering**	
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FG43-79R306062	**Lois (Lambros), Bethesda, MD (USA)**	
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FG44-80R410252	**Goerz (Jerry W.), Lexington, KY (USA)**	
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FG47-80CS69097	**Nebraska Energy Office, Lincoln (USA)**	
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FG48-81R803056	**Fowlkes Engineering, Bozeman, MT (USA)**	
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NAS-7-100-956679	**Purdue Univ., Lafayette, IN (USA)**	
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W-31-109-ENG-38	**Argonne National Lab., IL (USA)**	
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	10:44790	International Journal of Mass Spectrometry and Ion Physics 50 143-149 (1983).
	10:44791	Acta Crystallographica, Section C: Crystal Structure Communications C39 88-90 (1983).
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84-PE-1661	NTIS (US Sales Only), PC A02/MF A01	DE85752070	MN -34C	10:45529
CONF-780432-	(Conference on performance monitoring techniques for evaluation of solar heating and cooling systems, Washington, DC, USA, 3-4 Apr 1978)			
	See PB-85-197556			10:44076
CONF-790887-	(Gas Research Institute symposium on methane detection and measurements, Chicago, IL, USA, 27 Aug 1979)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85013214	MN -92	10:45080
CONF-791022-	(4. national passive solar energy conference, Kansas City, KS, USA, 3-5 Oct 1979)			
	See PB-85-195956			10:44075
CONF-791090-	(Symposium on potential environmental and health effects of atmospheric sulfur deposition, Gatlinburg, TN, USA, 14-18 Oct 1979)			
	See IVL-B-516			10:45095
	See IVL-B-545		ND -11	10:45096
CONF-8004248-	(Canadian Society of Mechanical Engineers council and general meeting, Calgary, Alberta, Canada, 1 Apr 1980)			
1	*See* AECL-8186	DE85702009	MN -80	10:44247
CONF-801197-	(Farm bureau energy idea symposium, Des Plaines, IL, USA, 18-19 Nov 1980)			
	American Farm Bureau Federation, 225 Touhy Ave., Park Ridge, IL 60068	TI81903329	ND -13	10:45209
CONF-8104104-	(SPIE technical symposium, Washington, DC, USA, 20-24 Apr 1981)			
	See PB-85-195980			10:45045
CONF-8105114-	(4. Warsaw symposium on elementary particle physics, Kazimierz, Poland, 1 May 1981)			
	See INIS-mf-9489	DE85781516	MN -34D	10:45535
CONF-810806-	(ANS conference on small break loss of coolant accident analysis in LWR's, Monterey, CA, USA, 25-27 Aug 1981)			
9	NTIS, PC A02/MF A01 - GPO	TI85015777	MN -78	10:44340
CONF-810836-	(3. international seminar on the containment of fast breeder reactors, Ispra, Italy, 24-25 Aug 1981)			
5	*See* UCRL-85704	TI85016720	MN -78	10:44435
CONF-8111228-	(Regional seminar for Asia and the Pacific Region - radiation emergency preparedness (health physics and medical aspects), Kalpakkam, India, 30 Nov-11 Dec 1981)			
	See RRC-55	DE85900956	MN -41	10:44419
CONF-8111229-	(Symposium on surface science and its industrial implications, Pretoria, South Africa, 1 Nov 1981)			
	National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa		MN -34A	10:44577
CONF-811231-	(Forward collider workshop, Madison, WI, USA, 10-12 Dec 1981)			
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CONF-8203208-	(American Crystallographic Association meeting, Washington, DC, USA, 29 Mar 1982)			
	Acta Crystallogr., Sect. C: Cryst. Struct. Commun., C39: 88-90(1983)			10:44791
CONF-8205171-	(National powder metallurgy conference, Montreal, Canada, 24-27 May 1982)			
	Metal Powder Industries Federation, 105 College Road East, Princeton, NJ 08540			10:44657
	Prog. Powder Metall., 38: 107-114(1983)			10:44875
CONF-8207120-	(Steam turbine blade reliability seminar and workshop, Boston, MA, USA, 7-9 Jul 1982)			
	See EPRI-CS-4001	TI85920224	ND -90h	10:44162
CONF-820933-	(International conference on radioactive waste management, Winnipeg, Manitoba, Canada, 12-15 Sep 1982)			
9	*See* AECL-7787	DE85902166	MN -70	10:43823
11	*See* INFO-0099	DE85702036	MN -2	10:43860
CONF-820973-	(International conference on decontamination of nuclear facilities, Niagara Falls, Canada, 19-22 Sep 1982)			
Exc.	*See* INIS-mf-9524	DE85781030	MN -4	10:43889
CONF-821175-	(Symposium on surface mining hydrology, sedimentology, and reclamation, Lexington, KY, USA, 1 Nov 1982)			
	Univ. Ky., Off. Eng. Serv., [Bull.], 57-63(Dec 1982)			10:43673

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CONF-8211146-	(Symposium on stationary combustion NO/sub x/ control, Dallas, TX, USA, 1-4 Nov 1982)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016810	MN -92a	10:43746
CONF-830188-	(Conference on continuum mechanics of solids, Oberwolfach, F.R. Germany, 2-8 Jan 1983)				
1	*See* INIS-mf-9323		DE85781555	MN -25	10:44604
CONF-830213-	(10. energy technology conference, Washington, DC, USA, 28 Feb-2 Mar 1983)				
3	NTIS, PC A02; 3		DE85016324	MN -95d	10:44524
CONF-830293-	(3. IAEA research co-ordination meeting on the treatment of spent ion-exchange resins, Cairo, Egypt, 28 Feb-4 Mar 1983)				
1	*See* AECL-7976		DE85702030	MN -70	10:43825
CONF-830311-	(Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983)				
198	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015186	MN -28	10:44930
CONF-830439-	(3. multi-phase flow and heat transfer symposium, Miami, FL, USA, 18-20 Apr 1983)				
12	*See* AECL-8065		DE85701975	MN -38	10:44888
CONF-8305155-	(4. specialists' meeting on water reactor fuel safety in off-normal and accident conditions, Roskilde, Denmark, 16-20 May 1983)				
2	*See* AECL-8069		DE85702000	MN -80	10:44301
CONF-8305276-	(Conference on muon plus spectroscopy, Aussois, France, 16-20 May 1983)				
1	*See* CEA-CONF-7007		DE85751149	MN -34	10:45742
CONF-830695-	(Health Physics Society annual meeting, Baltimore, MD, USA, 19-23 Jun 1983)				
12	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016369	MN -48	10:45217
CONF-830707-	(Summer computer simulation conference, Vancouver, Canada, 11-13 Jul 1983)				
7	*See* AECL-8107		DE85702018	MN -33	10:44272
CONF-830795-	(Symposium on energy removal and particle control and toroidal fusion devices, Princeton, NJ, USA, 26-29 Jul 1983)				
10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016362	MN -20	10:45824
CONF-830805-	(7. international conference on structural mechanics in reactor technology, Chicago, IL, USA, 22-26 Aug 1983)				
	Nucl. Eng. Des., 79: No. 2, 129-135(May 1984)				10:44437
CONF-8308190-	(12. IEEE international conference on parallel processing, Bellaire, MI, USA, 21-24 Aug 1983)				
1	*See* UCRL-89640	E 1.99:	DE85016097	MN -32	10:45922
CONF-830906-	(8. international conference on MHD electrical power generation, Moscow, USSR, 12-18 Sep 1983)				
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CONF-830932-	(International conference on numerical methods in nuclear engineering, Montreal, Canada, 6-9 Sep 1983)				
9	*See* AECL-8271		DE85701977	MN -38	10:44890
10	*See* AECL-8350		DE85701979	MN -38	10:44892
CONF-830969-	(12. international conference on solid state nuclear track detectors, Acapulco, Mexico, 4-10 Sep 1983)				
	Nucl. Tracks, 8: No. 1-4, 433-435(1984)				10:44767
CONF-8309347-	(28. annual conference of the Spectroscopy Society of Canada, Ottawa, Ontario, Canada, 1 Sep 1983)				
1	*See* AECL-8255		DE85701943	MN -25	10:44736
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)				
143	*See* AECL-7550		DE85702007	MN -80	10:44332
CONF-831079-	(CERN Accelerator School course on antiprotons for colliding beam facilities, Geneva, Switzerland, 11-21 Oct 1983)				
	See CERN-84-15		DE85701982	MN -28	10:44939
CONF-8310198-	(IAEA specialists on mechanical properties of structural materials, Chester, UK, 10-14 Oct 1983)				
Vol.2	*See* IWGFR-49-Vol.2		DE85781531	MN -25	10:44633
CONF-8310249-	(6. international symposium on environmental biogeochemistry, Santa Fe, NM, USA, 10-14 Oct 1983)				
Summ.	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85014690	MN -11	10:45136
CONF-8310339-	(NEACRP specialist meeting on in-core instrumentation and the assessment of reactor nuclear and thermal hydraulic performances, Halden, Norway, 10-13 Oct 1983)				
2	*See* AECL-8265		DE85702004	MN -80	10:44336
CONF-8311257-	(Consultants group meeting on use of irradiation as a quarantine treatment of agricultural commodities, Honolulu, HI, USA, 21-23 Nov 1983)				
	See IAEA-TECDOC-326		DE85781533	MN -48	10:45227
CONF-831205-	(6. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 12-14 Dec 1983)				
9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016385	MN -90d	10:43617

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CONF-840156-	(22. international meeting on nuclear physics, Bormio, Italy, 23-28 Jan 1984)			
8	*See* GANIL-P-84-01	DE85751182	MN -34C	10:45597
CONF-840158-	(INS winter school on accelerators for nuclear physics, Kikuchi, Japan, 29 Jan-2 Feb 1984)			
3	*See* GANIL-A-84-01	DE85751183	MN -28	10:44932
CONF-840168-	(DOE meeting on criteria for clean-up of transuranium in elements and soil, Germantown, MD, USA, 17-18 Jan 1984)			
	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99: DE85015564	MN -41	10:45143
CONF-840195-	(Meeting of the Intersecting Storage Rings Committee (IRSC), Geneva, Switzerland, 27 Jan 1984)			
1	*See* CERN-84-13	DE85701932	MN -34D	10:44929
CONF-840204-	(International seminar on energy conservation in industry, Duesseldorf, F.R. Germany, 13-15 Feb 1984)			
1	*See* CEA-CONF-7216	DE85750563	MN -97d	10:44155
CONF-8402150-	(Ecole Normale Superieure seminar on MA, Paris, France, 29 Feb 1984)			
1	*See* CEA-CONF-7223	DE85751185	MN -34C	10:45719
CONF-8402154-	(Seminar on dissimilar welds in fossil-fired boilers, New Orleans, LA, USA, 23-24 Feb 1984)			
	See EPRI-CS-3623	TI85920768	ND -90e	10:44161
CONF-8403121-	(New particle production at high energy meeting: The Recontre de Moriond, La Plagne, France, 4-10 Mar 1984)			
12	*See* CEA-CONF-7248	DE85751167	MN -34D	10:45466
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	J. Less-Common Met., 103: No. 2, 415(15 Nov 1984)			10:44655
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	J. Less-Common Met., 103: No. 2, 317-324(15 Nov 1984)			10:44684
CONF-8404135-	(International conference on metallurgical coatings, San Diego, CA, USA, 9-13 Apr 1984)			
	Thin Solid Films, 121: No. 2, 127-133(16 Nov 1984)			10:44682
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CONF-8404189-	(34. conference on nuclear spectroscopy and nuclear structure, Alma-Ata, USSR, 17-20 Apr 1984)			
2	*See* JINR-6-84-96	DE85701854	MN -34C	10:45638
CONF-8404234-	(8. international conference on solid compounds of the transition elements, Vienna, Austria, 9-13 Apr 1984)			
2	*See* CEA-CONF-7486	DE85752053	MN -25	10:44661
CONF-8404249-	(10. annual symposium on simulation of reactor dynamics and plant control, Saint John, New Brunswick, Canada, 9-10 Apr 1984)			
1	*See* AECL-8484	DE85702017	MN -80	10:44309
CONF-8404250-	(50. anniversary meeting of the Israel Chemical Society, Jerusalem, Israel, 10-12 Apr 1984)			
Absts.	*See* INIS-mf-9740	DE85781539	MN -34A	10:44777
CONF-840520-	(6. international conference on plasma surface interactions in controlled fusion devices, Nagoya, Japan, 14-18 May 1984)			
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CONF-8405332-	(Congress on numerical analysis, Bombannes, France, 21-25 May 1984)			
1-Summ.	*See* CEA-CONF-7337	DE85751184	MN -34C	10:45720
CONF-8405346-	(Solids transport workshop, Pittsburgh, PA, USA, 8-9 May 1984)			
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	J. Air Pollut. Control Assoc., No. 84-19.1, 1-16(1984)			10:45114
CONF-840613-	(24. annual international conference of the Canadian Nuclear Association and the 5. annual conference of the Canadian Nuclear Society, Saskatoon, Saskatchewan, Canada, 3-6 Jun 1984)			
1	*See* AECL-8335	DE85702012	MN -80	10:44337
CONF-840614-	(Annual meeting of the American Nuclear Society, New Orleans, LA, USA, 3-8 Jun 1984)			
106	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016381	MN -20	10:45825
CONF-840650-	(9. international conference on numerical methods in fluid dynamics, Saclay, France, 25-29 Jun 1984)			
3	*See* LBL-17947	E 1.99: DE85016560	MN -34	10:45409
CONF-8406129-	(MRS European meeting, Strasbourg, France, 5-8 Jun 1984)			
5	*See* CEA-CONF-7358	DE85751170	MN -25	10:44581
CONF-8406210-	(Symposium on tumor promotion and enhancement in the etiology of human and experimental respiratory tract carcinogenesis, Williamsburg, VA, USA, 17-20 Jun 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016387	MN -48	10:45259
CONF-8406243-	(Europhysics conference on nuclear reactions, Crete, Greece, 24-30 Jun 1984)			
2	*See* ISN-84-24	DE85751212	MN -34C	10:45603
CONF-8406257-	(84. x-ray astronomy congress, Bologna, Italy, 26-30 Jun 1984)			
1	*See* CEA-CONF-7432	DE85752049	MN -34B	10:45324
CONF-8406258-	(Colloquium on radiation chemistry, Mont-Saint-Odile, France, 12-15 Jun 1984)			
1-Abst.	*See* CEA-CONF-7719	DE85752063	MN -4	10:44832
2	*See* CEA-CONF-7311	DE85751155	MN -4	10:44831
CONF-8406260-	(27. colloquium on metallurgy, Saclay, France, 18-20 Jun 1984)			
2	*See* CEA-CONF-7364	DE85751187	MN -25	10:44660
CONF-8406263-	(Congress on glass and water, Brussels, Belgium, 14-15 Jun 1984)			
1	*See* CEA-CONF-7406	DE85751158	MN -70	10:44700
2	*See* CEA-CONF-7405	DE85751159	MN -70	10:44699
CONF-8406269-	(Pressurized fluidized-bed combustion power plants, Williamsburg, VA, USA, 20-22 Jun 1984)			
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CONF-840701-	(Topical meeting on fission product behavior and source term research, Snowbird, UT, USA, 15-19 Jul 1984)			
26	*See* AECL-8564	DE85702002	MN -80	10:44302
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)			
34	*See* JINR-E-2-84-260	DE85701919	MN -34D	10:45562
35	*See* JINR-R-2-84-250	DE85701913	MN -34D	10:45772
CONF-840764-	(3. international EXAFS conference, Stanford, CA, USA, 16-20 Jul 1984)			
7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85014041	MN -70	10:44703
CONF-840788-	(International conference on the physics of highly ionized atoms, Oxford, UK, 2-5 Jul 1984)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016359	MN -34A	10:45348
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CONF-840802-	(ANS International topical meeting on fuel reprocessing and waste management, Jackson Hole, WY, USA, 26-29 Aug 1984)			
28	*See* CEA-CONF-7632	DE85752077	MN -70	10:43830
30-Summ.	*See* CEA-CONF-7388	DE85751207	MN -70	10:43828
31	*See* CEA-CONF-7389	DE85751208	MN -70	10:43829

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-840807-	(Conference on chemical thermodynamics and 39. calorimetry conference, Hamilton, Canada, 13-17 Aug 1984)				
	J. Nucl. Mater., 130: 21-35(Feb 1985)				10:44286
	Amsterdam, Netherlands; North-Holland (1985).				10:44436
	J. Nucl. Mater., 130: 266-272(Feb 1985)				10:44678
	J. Nucl. Mater., 130: 489-504(Feb 1985)				10:44679
	J. Nucl. Mater., 130: 102-108(Feb 1985)				10:44726
	J. Nucl. Mater., 130: 227-233(Feb 1985)				10:44727
	J. Nucl. Mater., 130: 280-286(Feb 1985)				10:44787
6	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016389	MN -10	10:44842
CONF-840808-	(Symposium on thermodynamics of nuclear materials, Hamilton, Canada, 13-17 Aug 1984)				
	J. Nucl. Mater., 130: 21-35(Feb 1985)				10:44286
CONF-840812-	(International conference on photochemical combustion and storage of solar energy, Osaka, Japan, 26 Aug-1 Sep 1984)				
1-Summ.	*See* CEA-CONF-7583		DE85752376	MN -61E	10:43980
CONF-840835-	(10. annual underground coal gasification symposium, Williamsburg, VA, USA, 12-15 Aug 1984)				
	See DOE/METC-85/5	E 1.99:	DE85001956	MN -90c	10:43624
CONF-840872-	(SPIE annual technical symposium, San Diego, CA, USA, 19-24 Aug 1984)				
34	*See* CEA-CONF-7479		DE85752056	MN -25	10:44701
CONF-840876-	(International conference on valence fluctuations, Koln, F.R. Germany, 27-30 Aug 1984)				
7	*See* CEA-CONF-7392		DE85751188	MN -25	10:44698
CONF-8408139-	(INS-RIKEN international symposium on heavy ion physics, Tokyo, Japan, 24-25 Aug 1984)				
3	*See* GSI-85-9-Prepr.		DE85751892	MN -34C	10:45687
CONF-8408162-	(5. European conference on analytical chemistry, Cracow, Poland, 26 Aug-1 Sep 1984)				
1-Abst.	*See* CEA-CONF-7683		DE85752060	MN -10	10:43817
CONF-840914-	(International meeting on thermal nuclear reactor safety, Karlsruhe, F.R. Germany, 10-14 Sep 1984)				
Vol.1	*See* KFK-3880/1			ND -79p	10:44367
CONF-840928-	(12. summer school and symposium on the physics of ionized gases, Sibenik, Yugoslavia, 3-7 Sep 1984)				
2	*See* CEA-CONF-7523		DE85752058	MN -25	10:44586
CONF-840978-	(International symposium on high temperature corrosion in energy systems, Detroit, MI, USA, 17-19 Sep 1984)				
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85017087	MN -25	10:44588
CONF-8409102-	(EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics, St. Polten, Austria, 3-6 Sep 1984)				
8	*See* CEA-CONF-7450		DE85752068	MN -25	10:44582
9	*See* CEA-CONF-7452		DE85752073	MN -34B	10:44583
CONF-8409130-	(International conference on surface modification of metals by ion beams, Heidelberg, F.R. Germany, 17-21 Sep 1984)				
	Mater. Sci. Eng., 69: No. 2, 397-409(Mar 1985)				10:44652
	Mater. Sci. Eng., 69: No. 1, 1-11(Feb 1985)				10:44653
	Mater. Sci. Eng., 69: No. 2, 391-395(Mar 1985)				10:44675
	Mater. Sci. Eng., 69: No. 1, 123-127(Feb 1985)				10:44677
	Mater. Sci. Eng., 69: No. 2, 457-463(Mar 1985)				10:44992
CONF-8409134-	(4. workshop on polarized target materials and techniques, Bonn, F.R. Germany, 2-6 Sep 1984)				
4	*See* BONN-HE-85-06		DE85752085	MN -34C	10:45584
CONF-8409143-	(7. international conference on atomic masses and fundamental constants (AMCO-7), Darmstadt-Seeheim, F.R. Germany, 3-7 Sep 1984)				
12	*See* CERN-EP-84-110		DE85901939	MN -34	10:45652
CONF-8409144-	(Free electron laser conference, Castelgandolfo, Italy, 3-7 Sep 1984)				
5-Abst.	*See* CEA-CONF-7591		DE85752031	MN -28	10:44995
CONF-8409145-	(International colloquium on the physics and physicochemistry of highly condensed matter, Aussois, France, 11-14 Sep 1984)				
6	*See* CEA-CONF-7507		DE85752078	MN -25	10:44584
CONF-8409150-	(12. world conference of the International Nuclear Target Development Society, Antwerp, Belgium, 25-28 Sep 1984)				
5-Rev.1	*See* UCRL-91561-Rev.1	E 1.99:	DE85016070	MN -25	10:44646
CONF-8409187-	(8. international workshop on condensed matter theories, Granada, Spain, 17-28 Sep 1984)				
2	*See* CEA-CONF-7529		DE85752067	MN -34D	10:45467
CONF-8409194-	(6. international workshop on photon-photon collisions, Lake Tahoe, CA, USA, 9-13 Sep 1984)				
7	*See* LPC-84-28		DE85752065	MN -34D	10:45511
CONF-8409225-	(Colloquium on heavy ion collisions, Cargese, France, 2-15 Sep 1984)				
3	*See* IPNO-DRE-84-33		DE85752038	MN -34C	10:45633

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CONF-8409229-	(CECAM workshop transport, interactions and instabilities in laser-plasmas, Orsay, France, 24 Sep-5 Oct 1984)				
3	*See* UCRL-92739	E 1.99:	DE85016072	MN -34A	10:45412
CONF-8409239-	(8. symposium on photoelectronics images devices, London, UK, 5-7 Sep 1984)				
1	*See* CEA-CONF-7595		DE85752045	MN -37	10:45042
CONF-8409240-	(French Society of Chemistry congress, Nancy, France, 17-21 Sep 1984)				
1-Abst.	*See* CEA-CONF-7730		DE85752057	MN -4	10:44833
CONF-8409241-	(SFEN meeting on uranium enrichment, Paris, France, 26 Sep 1984)				
1	*See* CEA-CONF-7693		DE85752059	MN -22	10:43808
CONF-8409242-	(International conference on cerebro-vascular disease, Salzburg, Austria, 24-29 Sep 1984)				
1	*See* CEA-CONF-7629		DE85752076	MN -48	10:45200
CONF-8409264-	(Navy CPB material interaction workshop, Silver Spring, MD, USA, 24-26 Sep 1984)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017093	MN -25	10:45723
CONF-841009-	(4. symposium on titanium and zirconium in industrial applications, Philadelphia, PA, USA, 10-11 Oct 1984)				
1	*See* CEA-CONF-7511		DE85781586	MN -25	10:44585
CONF-841014-	(International conference on nuclear and radiochemistry, Lindau, Bodensee, F.R. Germany, 8-12 Oct 1984)				
3	*See* CEA-CONF-7689		DE85752062	MN -25	10:44662
CONF-841071-	(European wind energy conference and exhibition, Hamburg, F.R. Germany, 23-26 Oct 1984)				
10	*See* CEA-CONF-7783		DE85752377	MN -60	10:44138
CONF-8410142-	(12. water reactor safety research information meeting, Gaithersburg, MD, USA, 23-26 Oct 1984)				
84	NTIS, PC A02/MF A01 - GPO (GPO Dep.)	E 1.99:	TI85016146	MN -78	10:44186
CONF-8410227-	(Workshop on electron and photon interactions at medium energies, Bad Honnef, F.R. Germany, 29 Oct 1984)				
2	*See* BONN-HE-85-1		DE85751891	MN -34D	10:45579
3	*See* BONN-HE-85-05		DE85752084	MN -28	10:44963
CONF-8410280-	(Autumn meeting on metallurgy, Paris, France, 23-25 Oct 1984)				
1-Abst.	*See* CEA-CONF-7677		DE85752054	MN -25	10:44702
CONF-8410311-	(Workshop on radionuclide migration, Chicago, IL, USA, 1-3 Oct 1984)				
1	*See* LBL-18587	E 1.99:	DE85016555	MN -70	10:43890
CONF-8411141-	(Workshop on tungsten for VLSI applications, Albuquerque, NM, USA, 12-13 Nov 1984)				
2	*See* K/PS-5048	E 1.99:	DE85016250	MN -4	10:44781
CONF-8411142-	(2. international workshop on cross sections for fusion and other applications, College Station, TX, USA, 8-10 Nov 1984)				
2	*See* GSI-85-1-Prepr.		DE85751870	MN -34A	10:45354
CONF-8411170-	(National colloquium on fluorine and fluorinated compounds, Bordeaux, France, 15-17 Nov 1984)				
1-Abst.	*See* CEA-CONF-7718		DE85752055	MN -4	10:44840
CONF-8411186-	(Workshop on e+e- physics at high luminosities, Stanford, CA, USA, 30 Nov-1 Dec 1984)				
	See SLAC-283	E 1.99:	DE85016524	MN -34D	10:45455
CONF-841210-	(International chemical congress of Pacific Basin Society, Honolulu, HI, USA, 16-21 Dec 1984)				
24	*See* CEA-CONF-7703		DE85752061	MN -4	10:44737
CONF-841244-	(Design of field scale experiments: subsurface transport of organics, Princeton, NJ, USA, 17-18 Dec 1984)				
Summ.	*See* DOE/ER-0230	E 1.99:	DE85015284	MN -11	10:45171
CONF-841259-	(International conference on nuclear physics, Bombay, India, 27-31 Dec 1984)				
5	*See* GSI-85-5-Prepr.		DE85751889	MN -34C	10:45682
CONF-841269-	(PCB by-product formation workshop, Palo Alto, CA, USA, 4-6 Dec 1984)				
	See EPRI-CS/EL-4104		TI85920731	ND -97	10:45282
CONF-841274-	(AGU fall meeting, San Diego, CA, USA, 3-7 Dec 1984)				
1	*See* CEA-CONF-7787		DE85752371	MN -11	10:45298
CONF-850123-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting, Chicago, IL, USA, 27-31 Jan 1985)				
4	*See* SERI/TP-253-2435	E 1.99:	DE85012164	MN -59B	10:44079
CONF-850128-	(2. international workshop on laser acceleration of particles, Los Angeles, CA, USA, 7-18 Jan 1985)				
18	*See* UCRL-92172	E 1.99:	DE85016071	MN -28	10:44961
CONF-850129-	(International symposium on radioactivity, Pune, India, 8-12 Jan 1985)				
1	*See* GSI-85-10-Prepr.		DE85751895	MN -34C	10:45666

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CONF-850141-	(13. international workshop on gross properties of nuclei and nuclear excitations, Hirschegg, Austria, 14-19 Jan 1985)			
5	*See* GSI-85-6-Prepr.	DE85751890	MN -34C	10:45683
CONF-850152-	(3. LEAR workshop, Tignes-Savoie, France, 19-26 Jan 1985)			
7	*See* CERN-EP-85-49	DE85901959	MN -28	10:44944
14	*See* CERN-EP-85-50	DE85901955	MN -28	10:45014
CONF-850163-	(Workshop on Dirac approaches to nuclear physics, Los Alamos, NM, USA, 31 Jan-2 Feb 1985)			
	See LA-10438-C	E 1.99: DE85016203	STD -34C	10:45709
CONF-850173-	(23. international winter meeting on nuclear physics, Bormio, Italy, 21-26 Jan 1985)			
2	*See* GSI-85-16-Prepr.	DE85752087	MN -34C	10:45667
CONF-850174-	(Lasers '84, San Francisco, CA, USA, 15 Jan 1985)			
2	*See* UCRL-92087	DE85012977	MN -21	10:45861
CONF-850266-	(2. international school for space simulation, Honolulu, HI, USA, 3-15 Feb 1985)			
7	*See* UCRL-91640	E 1.99: DE85016074	MN -34	10:45784
CONF-850278-	(5. topical workshop on proton-anti-proton collider physics, St. Vincent, Italy, 25 Feb-1 Mar 1985)			
5	*See* CERN-EP-85-64	DE85901953	MN -34D	10:45415
CONF-850294-	(SHARE 64 conference, Los Angeles, CA, USA, 24 Feb-1 Mar 1985)			
1	*See* SLAC-PUB-3712	E 1.99: DE85015263	MN -28	10:44991
CONF-850295-	(2. IEEE international conference on data engineering, Los Angeles, CA, USA, 4 Feb 1985)			
1	*See* LA-UR-85-2329	E 1.99: DE85015683	MN -32	10:45928
CONF-850310-	(6. topical meeting on the technology of fusion energy, San Francisco, CA, USA, 3-7 Mar 1985)			
116	*See* PPPL-2224	E 1.99: DE85015305	STD -20a	10:45857
CONF-850345-	(Southwest conference on optics, Albuquerque, NM, USA, 4-8 Mar 1985)			
26	*See* LA-UR-85-2245	E 1.99: DE85014078	MN -21	10:45851
30	*See* LA-UR-85-2351	E 1.99: DE85015677	MN -21	10:45852
31	*See* LA-UR-85-2380	E 1.99: DE85015668	MN -38	10:44878
CONF-850351-	(30. international gas turbine conference and exhibit, Houston, TX, USA, 18-21 Mar 1985)			
	Am. Soc. Mech. Eng., [Pap.], 85-GT-8: 6(Mar 1985)			10:43672
CONF-850375-	(20. Recontre de Moriond, Les Arcs, France, 10-23 Mar 1985)			
17	*See* BNL-36724	E 1.99: DE85016058	MN -34	10:45464
18	*See* DOE/ER/40033-82	E 1.99: DE85015292	MN -34B	10:45422
19	*See* UCRL-92972	E 1.99: DE85016288	MN -34B	10:45335
CONF-8503105-	(Orbital dynamics and applications to accelerators workshop, Berkeley, CA, USA, 7-12 Mar 1985)			
7	*See* LBL-19798	E 1.99: DE85016566	MN -28	10:44960
CONF-8503158-	(SERI aquatic species review - principal investigators meeting, Golden, CO, USA, 20-21 Mar 1985)			
	See SERI/CP-231-2700	E 1.99: DE85012137	MN -61C	10:44010
CONF-8503159-	(Workshop on antennas and reaction centers of photosynthetic bacteria - structure, interactions and dynamics, Feldafing, F.R. Germany, 23-25 Mar 1985)			
1	*See* BNL-36836	E 1.99: DE85015835	MN -48	10:43979
CONF-8503160-	(UCLA symposium on animal forms, Salt Lake City, UT, USA, 30 Mar-4 Apr 1985)			
1	*See* LA-UR-85-990	E 1.99: DE85009637	MN -48	10:45196
CONF-8503161-	(Annual review of BPA-funded projects in natural and artificial propagation of salmonids, Portland, OR, USA, 27-29 Mar 1985)			
Abstr.	*See* DOE/BP-421	E 1.99: DE85015782	MN -11	10:45188
CONF-8503163-	(Workshop on risk assessment methods for biotechnology, Washington, DC, USA, 28-29 Mar 1985)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016964	MN -11	10:45260
CONF-850406-	(International symposium and workshop on particulate and multi-phase processes and the 16th annual meeting of the Fine Particle Society, Miami Beach, FL, USA, 22-26 Apr 1985)			
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85014984	MN -4	10:44895
CONF-850417-	(189. national meeting of the American Chemical Society, Miami, FL, USA, 28 Apr-3 May 1985)			
24	*See* HEDL-SA-3237	E 1.99: DE85013748	MN -79a	10:44259
26	*See* IS-M-544	E 1.99: DE85015513	MN -90a	10:43653
CONF-850421-	(2. spring meeting of the Materials Research Society, San Francisco, CA, USA, 15-18 Apr 1985)			
13	*See* SERI/TP-213-2689	E 1.99: DE85012166	MN -63	10:44014
14	*See* SAND-84-2487C	DE85015149	MN -25	10:44718
CONF-850425-	(Executive conference on remote operations and robotics in the nuclear industry, Pine Mountain, GA, USA, 21-24 Apr 1985)			
4	*See* HEDL-SA-3301-FP	E 1.99: DE85013745	MN -71	10:43822

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CONF-850470-	(4. international conference on electrostatic accelerator technology and associated boosters, Buenos Aires, Argentina, 15-19 Apr 1985)			
8	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016394	MN -28	10:44931
CONF-8504115-	(5. international conference on crystalline field effects in f-electron systems: ICCF5, Sendai, Japan, 15-18 Apr 1985)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85014961	MN -34A	10:44596
CONF-8504133-	(International conference on hadron spectroscopy, College Park, MD, USA, 20-22 Apr 1985)			
9	*See* SLAC-PUB-3643	E 1.99: DE85015970	MN -34D	10:45456
CONF-8504150-	(International conference on fluid dynamics, Reading, England, 1-4 Apr 1985)			
2	*See* LA-UR-85-2479	E 1.99: DE85015707	MN -34	10:45916
CONF-8504152-	(Workshop on experiments for RHIC, Upton, NY, USA, 15-19 Apr 1985)			
4	*See* BNL-36748	E 1.99: DE85016053	MN -34D	10:45009
CONF-8504155-	(PEP high luminosity workshop, Stanford, CA, USA, 5-6 Apr 1985)			
	See SLAC-283	E 1.99: DE85016524	MN -34D	10:45455
CONF-8504163-	(8. international conference on solid compounds of the transition elements, Vienna, Austria, 7-13 Apr 1985)			
1	*See* IS-M-547	E 1.99: DE85015522	MN -4	10:44778
CONF-8504166-	(Woodgas in practice seminar - forest products research international symposium, Pretoria, South Africa, 22-26 Apr 1985)			
1	*See* PNL-SA-12841	E 1.99: DE85015804	MN -61F	10:43933
CONF-8504167-	(Conference on advances in lattice gauge theory, Coral Gables, FL, USA, 10-13 Apr 1985)			
1	*See* BNL-36727	E 1.99: DE85016059	MN -34	10:45546
CONF-8504170-	(DOE radiological and chemical physics contractors' meeting, Richland, WA, USA, 9-10 Apr 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016062	MN -48	10:45261
CONF-850504-	(Particle accelerator conference, Vancouver, Canada, 13-16 May 1985)			
103-Rev.	*See* SLAC-PUB-3624-Rev.	E 1.99: DE85014956	MN -28	10:44990
239	*See* LBL-19560	DE85016554	MN -28	10:44959
240	*See* LBL-19529	E 1.99: DE85016564	MN -21	10:45855
241	*See* LBL-19647	E 1.99: DE85016636	MN -21	10:45856
242	*See* LBL-19486	E 1.99: DE85016556	MN -28	10:45002
243	*See* LBL-19488	E 1.99: DE85016563	MN -28	10:45003
244	*See* LBL-19561	E 1.99: DE85016634	MN -28	10:44979
245	*See* LBL-19584	E 1.99: DE85016635	MN -28	10:44980
246	*See* LBL-19483	DE85016637	MN -28	10:44957
247	*See* FNAL-TM-1323	E 1.99: DE85016984	STD -28	10:45912
248	*See* FNAL-TM-1331	E 1.99: DE85016988	STD -28	10:44949
249	*See* FNAL-TM-1317	E 1.99: DE85016986	STD -28	10:44946
250	*See* FNAL-TM-1318	E 1.99: DE85016990	STD -28	10:44947
251	*See* FNAL-TM-1319	DE85016983	STD -28	10:44973
252	*See* FNAL-TM-1322	DE85016985	STD -28	10:44975
253	*See* FNAL-TM-1320	E 1.99: DE85016991	STD -28	10:44974
254	*See* FNAL-TM-1333	E 1.99: DE85016992	STD -28	10:44950
255	*See* LBL-19527	E 1.99: DE85016561	MN -28	10:44958
257	*See* LBL-19487	E 1.99: DE85016628	MN -28	10:44978
258	*See* FNAL-TM-1332	E 1.99: DE85016994	STD -28	10:44976
259	*See* FNAL-TM-1321	E 1.99: DE85016993	STD -28	10:44948
261	*See* LBL-19620	E 1.99: DE85016626	MN -28	10:44933
262-Rev.	*See* LBL-17827-Rev.	E 1.99: DE85016644	MN -28	10:45396
280	*See* LBL-18797	E 1.99: DE85016559	MN -28	10:44956
CONF-850507-	(International conference on nuclear data for basic and applied science, Santa Fe, NM, USA, 13-17 May 1985)			
49	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016398	MN -25	10:45628
51	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016158	MN -78	10:44182
CONF-850513-	(Symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 13-17 May 1985)			
3	*See* PNL-SA-13200	E 1.99: DE85016278	MN -61D	10:43934
CONF-850564-	(5. annual national symposium on recent advances in the measurement of air pollutants, Raleigh, NC, USA, 14-16 May 1985)			
1	*See* PNL-SA-13013S	E 1.99: DE85016620	MN -11	10:44756
CONF-8505100-	(7. US symposium on compact toroid research, Santa Fe, NM, USA, 21-23 May 1985)			
18	*See* UCRL-92689	E 1.99: DE85016069	MN -20b	10:45785
CONF-8505139-	(9. annual actinide separations workshop, Richland, WA, USA, 22-24 May 1985)			
7	*See* RHO-RE-SA-95P	E 1.99: DE85017053	MN -70	10:43870
9	*See* RFP-3826	E 1.99: DE85013216	MN -70	10:43868
CONF-8505164-	(Workshop on high brightness, high current, high duty factor ion injectors, San Diego, CA, USA, 21-23 May 1985)			
3	*See* LA-UR-85-1627	E 1.99: DE85015689	MN -28	10:44954
6	*See* LA-UR-85-2556	E 1.99: DE85015694	MN -28	10:44955

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CONF-8505175-	(TPSS meeting, Atlanta, GA, USA, 15-16 May 1985)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016399	MN -20	10:45830
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016396	MN -20	10:45831
CONF-8505180-	(Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste, Albuquerque, NM, USA, 20-21 May 1985)				
3	*See* SAND-85-0823C		TI85016457	MN -70	10:43892
CONF-8505187-	(2. Pan-Pacific conference - a business, economic and technological exchange, Seoul, Korea, 13-15 May 1985)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015799	MN -95	10:44457
CONF-850601-	(7. international conference on zirconium in the nuclear industry, Stasbourg, France, 24-27 Jun 1985)				
1	NTIS, PC A04/MF A01 - GPO		TI85014994	MN -80	10:44183
2	*See* PNL-SA-13122	E 1.99:	DE85016281	MN -25	10:44640
CONF-850604-	(INTERSOL '85 - Solar energy--the diverse solution, Montreal, Canada, 23-29 Jun 1985)				
14	*See* LBL-19842	E 1.99:	DE85016548	MN -62	10:44092
15	*See* PNL-SA-13094	E 1.99:	DE85016614	MN -62	10:43978
CONF-850605-	(7. international conference on laser spectroscopy, Maui, HI, USA, 24-28 Jun 1985)				
3	*See* LBL-19854	E 1.99:	DE85016629	MN -4	10:45397
CONF-850606-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting, Honolulu, HI, USA, 23-27 Jun 1985)				
12	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016406	MN -95d	10:44525
13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016419	MN -95d	10:44526
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016408	MN -95d	10:44527
CONF-850610-	(Annual meeting of the American Nuclear Society, Boston, MA, USA, 9-14 Jun 1985)				
33	*See* PNL-SA-12852	E 1.99:	DE85016276	MN -23	10:43919
37	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016415	MN -20	10:45826
41	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016411	MN -20c	10:45827
45	*See* DP-MS-85-25	E 1.99:	DE85016569	MN -23	10:43918
CONF-850612-	(Air Pollution Control Association annual meeting and exhibition, Detroit, MI, USA, 16-21 Jun 1985)				
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016407	MN -70B	10:43856
7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016418	MN -11	10:45081
8	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017045	MN -11	10:45072
CONF-850614-	(ASME-ASCE fluids engineering conference and joint mechanics conference, Albuquerque, NM, USA, 24-26 Jun 1985)				
6	*See* SAND-85-0261C	E 1.99:	DE85015147	MN -70	10:43876
CONF-850616-	(5. IEEE pulsed power conference, Washington, DC, USA, 10-12 Jun 1985)				
68	*See* LA-UR-85-2077	E 1.99:	DE85014112	MN -21	10:45850
CONF-850617-	(9. symposium on thermophysical properties, Boulder, CO, USA, 24-27 Jun 1985)				
4	*See* MLM-3273(OP)	E 1.99:	DE85016449	MN -4	10:44782
CONF-850637-	(12. international radiocarbon conference, Trondheim, Norway, 24-28 Jun 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016154	MN -11	10:45167
CONF-850641-	(5. conference on the computation of electromagnetic fields, Ft. Collins, CO, USA, 3-6 Jun 1985)				
5	*See* RFP-3835	E 1.99:	DE85013221	MN -80	10:44418
CONF-850659-	(11. international conference on numerical simulation of plasmas, Montreal, Quebec, Canada, 25-27 Jun 1985)				
1	*See* UCRL-92041	E 1.99:	DE85016073	MN -32	10:45411
CONF-850670-	(ASME Pressure Vessel and Piping Division conference, New Orleans, LA, USA, 24-29 Jun 1985)				
23	*See* PNL-SA-12634	E 1.99:	TI85016279	MN -38	10:44865
CONF-850690-	(Anaerobic treatment of sewage: seminar and workshop, Amherst, MA, USA, 27-28 Jun 1985)				
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016965	MN -95e	10:45168
CONF-8506106-	(Robots 9 conference, Detroit, MI, USA, 2-6 Jun 1985)				
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016404	MN -38	10:44854
CONF-8506108-	(17. biennial conference on carbon, Lexington, KY, USA, 16-21 Jun 1985)				
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016595	MN -25	10:44705
CONF-8506117-	(41. meeting of the IMOG subgroup on environmental testing, Miamisburg, OH, USA, 18 Jun 1985)				
2	*See* MLM-3280(OP)	E 1.99:	DE85016445	MN -38	10:45054
CONF-8506118-	(International conference on Fourier and computerized infrared spectroscopy, Ottawa, Canada, 24-28 Jun 1985)				
2	*See* UCRL-92414	E 1.99:	DE85016442	MN -4	10:45047
CONF-8506119-	(Working group meeting on synthesis of high energy materials, Dover, NJ, USA, 4-6 Jun 1985)				
2	*See* LA-UR-85-2375		DE85015670	MN -4	10:44805

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CONF-8506121-	(International conference on lightning and static electricity, Paris, France, 10-13 Jun 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016367	MN -97	10:44152
CONF-8506124-	(International symposium on the stochastic approach to subsurface flow, Montvillargenne, France, 2-7 Jun 1985)			
2	*See* PNL-SA-13177	E 1.99: DE85016280	MN -11	10:45291
CONF-8506125-	(Conference on internal friction and ultrasonic attenuation in solids, Urbana, IL, USA, 3-6 Jun 1985)			
5	*See* LA-UR-85-2504	E 1.99: DE85015702	MN -34	10:45745
6	*See* LA-UR-85-2481	E 1.99: DE85015705	MN -25	10:44636
CONF-8506137-	(4. international conference on environmental mutagens, Stockholm, Sweden, 24-28 Jun 1985)			
9	*See* UCRL-92836	E 1.99: DE85016084	MN -48	10:45197
10	*See* UCRL-92883	E 1.99: DE85016082	MN -48	10:45250
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85017313	MN -48	10:45262
CONF-8506147-	(National conference on microcomputers in urban transportation, San Diego, CA, USA, 17-21 Jun 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85014311	MN -96	10:45900
CONF-8506150-	(Neutralizer workshop, Upton, NY, USA, 5-6 Jun 1985)			
2	*See* LA-UR-85-2595	E 1.99: DE85015747	MN -28	10:45394
3	*See* LA-UR-85-2596	E 1.99: DE85015746	MN -28	10:45395
CONF-8506152-	(CEBAF summer workshop, Newport News, VA, USA, 3-7 Jun 1985)			
1	*See* LA-UR-85-2161	E 1.99: DE85014098	MN -34C	10:45582
3	*See* FNAL-TM-1336	E 1.99: DE85016995	STD -28	10:44951
CONF-8506165-	(Workshop on the relation between mechanical properties and micro-structure under fusion irradiation conditions, Ebeltoft, Denmark, 27 Jun-2 Jul 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016317	MN -25	10:44597
CONF-8506167-	(Forest land applications symposium, Seattle, WA, USA, 25-28 Jun 1985)			
1	*See* DP-MS-85-34	E 1.99: DE85015828	MN -11	10:45150
2	*See* DP-MS-85-62	E 1.99: DE85017058	MN -61	10:43998
CONF-8506169-	(17. AMS-SIAM summer seminar in applied mathematics, Ithaca, NY, USA, 30 Jun-13 Jul 1985)			
1	*See* SAND-85-0397C	E 1.99: DE85016160	MN -38	10:45056
CONF-8506170-	(International conference on the health of miners, Pittsburgh, PA, USA, 2-7 Jun 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016370	MN -41	10:43708
CONF-8506171-	(5. European conference on CVD, Uppsala, Sweden, 17-20 Jun 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016402	MN -90h	10:44686
CONF-8506172-	(7. Southern Forest biomass workshop, Gainesville, FL, USA, 11-14 Jun 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016374	MN -61A	10:43992
CONF-8506173-	(Workshop on polarized beams at the SSC, Ann Arbor, MI, USA, 10-15 Jun 1985)			
1	*See* BNL-36779	E 1.99: DE85016064	MN -28	10:44937
2	*See* BNL-36782	E 1.99: DE85016060	MN -28	10:44938
CONF-8506174-	(2. asteroids, comets, and meteors symposium, Uppsala, Sweden, 3-6 Jun 1985)			
1	*See* LA-UR-85-2457	E 1.99: DE85015713	MN -34B	10:45329
CONF-8506175-	(10. annual meeting of the Technology Transfer Society, San Francisco, CA, USA, 24-27 Jun 1985)			
1	*See* PNL-SA-12976	E 1.99: DE85016622	MN -13	10:44465
CONF-8506178-	(Cretan international meeting on subatomic physics, Crete, Greece, 23-29 Jun 1985)			
1	*See* PNL-SA-13271	E 1.99: DE85016618	MN -34A	10:45627
CONF-8506180-	(Workshop on persistent toxic substances and the health of aquatic communities, Minneapolis, MN, USA, 17-21 Jun 1985)			
1	NTIS, PC A03; 3	DE85017302	MN -11	10:45170
CONF-850706-	(8. international symposium on detonation, Albuquerque, NM, USA, 15-19 Jul 1985)			
26	*See* SAND-85-1545C	E 1.99: DE85014700	MN -45	10:45059
CONF-850708-	(Workshop on tokamak start-up - problems and scenarios related to the transient phases of long-burn operations, Erice, Italy, 14-20 Jul 1985)			
2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016149	MN -20	10:45828
CONF-850713-	(International conference on nuclear power plant aging, availability factor and reliability analysis, San Diego, CA, USA, 3-13 Jul 1985)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016355	MN -80	10:44252
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016472	MN -79h	10:44253
CONF-850721-	(International Europhysics conference on high energy physics, Bari, Italy, 18-24 Jul 1985)			
1	*See* SLAC-PUB-3713	E 1.99: DE85015259	MN -28	10:45004
CONF-850726-	(Workshop on radiation survey instruments and calibrations, Gaithersburg, MD, USA, 10-12 Jul 1985)			
2	*See* PNL-SA-13271	E 1.99: DE85016623	MN -41	10:45024

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CONF-850736-	(American Physical Society topical conference on shock waves in condensed matter, Spokane, WA, USA, 22-26 Jul 1985)				
42	*See* SAND-85-0483C	E 1.99:	DE85015164	MN -25	10:44641
52	*See* LA-UR-85-2410	E 1.99:	DE85015725	MN -4	10:44806
54	*See* SAND-85-0568C	E 1.99:	DE85016131	MN -45	10:44902
55	*See* UCRL-92899	E 1.99:	DE85016079	MN -34A	10:44649
58	*See* UCRL-92776	E 1.99:	DE85016943	MN -45	10:44648
59	*See* LA-UR-85-2515	E 1.99:	DE85015700	MN -25	10:44637
61-Rev.1	*See* UCRL-89753-Rev.1	E 1.99:	DE85017401	MN -34A	10:45410
CONF-850749-	(4. symposium on coastal and ocean management, Baltimore, MD, USA, 30 Jul-2 Aug 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016315	MN -11	10:45175
CONF-850753-	(International Metallographic Society conference, Denver, CO, USA, 21-22 Jul 1985)				
5	*See* MLM-3281(OP)	E 1.99:	DE85016450	MN -25	10:44669
CONF-850759-	(10. high pressure conference on research in high pressure science and technology, Amsterdam, Netherlands, 8-11 Jul 1985)				
10	*See* LA-UR-85-2440	E 1.99:	DE85015718	MN -25	10:44717
11	*See* LA-UR-85-2330	E 1.99:	DE85015682	MN -34A	10:44750
CONF-850761-	(1. annual tar sand/oil shale contractors' meeting, Morgantown, WV, USA, 9-11 Jul 1985)				
6	*See* PNL-SA-13211	E 1.99:	DE85016613	MN -91	10:43764
CONF-850762-	(8. meeting of international collaboration on advanced neutron sources, Oxford, UK, 7-12 Jul 1985)				
4	*See* LA-UR-85-2422	E 1.99:	DE85015721	MN -34C	10:45583
CONF-850765-	(26. annual meeting of the Institute of Nuclear Materials Management, Albuquerque, NM, USA, 21-24 Jul 1985)				
18	*See* LA-UR-85-2566		DE85015692	MN -15	10:43905
19	*See* LA-UR-85-2736	E 1.99:	DE85015730	MN -15	10:43907
20	*See* LA-UR-85-2398	E 1.99:	DE85015667	MN -15	10:43903
21	*See* LA-UR-85-2417	E 1.99:	DE85015722	MN -15	10:43904
22	*See* LA-UR-85-2567	E 1.99:	DE85015752	MN -15	10:43906
24	*See* K/OA-5929	E 1.99:	DE85015802	MN -15	10:43902
26	*See* MLM-3274	E 1.99:	DE85016447	MN -15	10:44751
28	*See* SAND-85-1635C	E 1.99:	DE85017115	MN -15	10:43910
30	*See* DP-MS-83-50	E 1.99:	DE85016568	MN -15	10:43901
CONF-850767-	(15. international symposium on shock waves and shock tubes, Berkeley, CA, USA, 29 Jul-2 Aug 1985)				
3	*See* UCRL-92974	E 1.99:	DE85016443	MN -34A	10:45401
CONF-850769-	(Conference on modelling and simulation, Storrs, CT, USA, 1-3 Jul 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015004	MN -79	10:44341
CONF-850770-	(EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena, Portland, OR, USA, 28 Jul-1 Aug 1985)				
1	*See* SAND-85-0266C	E 1.99:	DE85014641	MN -35	10:45308
3	*See* UCRL-91697	E 1.99:	DE85016444	MN -25	10:45746
4	*See* SAND-85-1661C	E 1.99:	DE85016577	MN -45	10:44671
5	*See* SAND-85-1706C	E 1.99:	DE85016816	MN -45	10:44784
CONF-850773-	(American Society of Agricultural Engineers, East Lansing, MI, USA, 8 Jul 1985)				
1	*See* PNL-SA-13281	E 1.99:	DE85016611	MN -61D	10:43935
CONF-850774-	(International conference on hot electrons, Innsbruck, Austria, 8-12 Jul 1985)				
1	*See* UCRL-92936	E 1.99:	DE85016128	MN -34A	10:44722
CONF-850775-	(International clay mineral conference, Denver, CO, USA, 28 Jul-2 Aug 1985)				
1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85017158	MN -11	10:45287
CONF-850777-	(3. international aluminum-lithium conference, Oxfordshire, England, 9-11 Jul 1985)				
1	*See* LBL-19235	E 1.99:	DE85016570	MN -25	10:44638
CONF-850778-	(Polymer flow workshop, La Jolla, CA, USA, 10-12 Jul 1985)				
1	*See* SAND-85-1582C	E 1.99:	DE85017121	MN -34	10:45400
CONF-850781-	(International conference on radiation effects in insulators, Guildford, Surrey, UK, 15-19 Jul 1985)				
1	*See* PNL-SA-13093	E 1.99:	DE85016273	MN -70	10:43867
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015415	MN -25	10:44663
CONF-850784-	(Computer analysis for life science, Okayama, Japan, 9-12 Jul 1985)				
1	*See* LA-UR-85-2368	E 1.99:	DE85015672	MN -48	10:45207
CONF-850786-	(International conference on the physics and chemistry of boron and boron-rich borides, Albuquerque, NM, USA, 29-31 Jul 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016930	MN -4	10:44771
CONF-850788-	(32. international field emission symposium, Wheeling, WV, USA, 15-19 Jul 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85017154	MN -25	10:44589

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CONF-850801-	(International symposium on geothermal energy, Kailua Kona, HI, USA, 26-30 Aug 1985)			
42	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016320	MN -66i	10:44131
CONF-850808-	(20. intersociety energy conversion engineering conference, Miami Beach, FL, USA, 18-23 Aug 1985)			
14	*See* SERI/TP-251-2725	E 1.99: DE85008818	MN -64	10:44027
15	*See* SERI/TP-211-2733	E 1.99: DE85012133	MN -63	10:44013
16	*See* LA-UR-85-2648	E 1.99: DE85015744	MN -33	10:44273
19	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016314	MN -93	10:44926
CONF-850809-	(8. international conference on structural mechanics in reactor technology, Brussels, Belgium, 19-23 Aug 1985)			
4	*See* SAND-84-1487C	E 1.99: DE85006760	MN -80	10:44299
47	*See* BNL-NUREG-36108	E 1.99: TI85010232	MN -78	10:44215
CONF-850810-	(National heat transfer conference, Denver, CO, USA, 4-7 Aug 1985)			
24	*See* LBL-19102	E 1.99: DE85016550	MN -62	10:44091
CONF-850813-	(11. international conference on atomic collisions in solids, Washington, DC, USA, 4-9 Aug 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016604	MN -21	10:45829
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016931	MN -34A	10:44704
CONF-850814-	(Cryogenic engineering conference and international cryogenic materials conference, Boston, MA, USA, 12-16 Aug 1985)			
1	*See* UCRL-92345	E 1.99: DE85016650	STD -20b	10:44647
CONF-850830-	(10. international colloquium on dynamics of explosions and reactive systems, Berkeley, CA, USA, 4-9 Aug 1985)			
5	*See* SAND-85-1386C	E 1.99: DE85013777	MN -78	10:44428
CONF-850836-	(American Institute of Chemical Engineers national meeting, Seattle, WA, USA, 25-28 Aug 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016321	MN -90d	10:43618
CONF-850840-	(Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society, Louisville, KY, USA, 5-9 Aug 1985)			
10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016309	MN -25	10:44664
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016587	MN -25	10:44590
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016588	MN -25	10:44739
13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016963	MN -25	10:44575
CONF-850858-	(US/India binational symposium on solar energy research and applications, Roorkee, India, 5-8 Aug 1985)			
2	*See* SERI/TP-252-2757	E 1.99: DE85012169	MN -64	10:44028
3	*See* SERI/TP-216-2787	E 1.99: DE85012165	MN -63	10:44015
CONF-850864-	(Forum 85, Helsingor, Denmark, 26-29 Aug 1985)			
2	*See* LA-UR-85-2740	E 1.99: DE85015729	MN -13	10:45897
CONF-850871-	(International conference on neutron scattering, Santa Fe, NM, USA, 19-24 Aug 1985)			
3-Draft	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016298	MN -25	10:44323
4-Draft	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016295	MN -25	10:44591
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016935	MN -48	10:45193
CONF-850877-	(American Crystallographic Association meeting, Stanford, CA, USA, 18-23 Aug 1985)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016589	MN -25	10:44576
CONF-850883-	(19. international cosmic ray conference, La Jolla, CA, USA, 11-23 Aug 1985)			
7	*See* SAND-85-1521C	E 1.99: DE85016938	MN -34B	10:45333
CONF-850885-	(1. annual AFCEA symposium and exposition on physical and electronic security, Philadelphia, PA, USA, 19-21 Aug 1985)			
4	*See* SAND-85-1790C	E 1.99: DE85016167	MN -15	10:43911
CONF-850887-	(SPIE international technical symposium on optical and electro-optical engineers, San Diego, CA, USA, 18-23 Aug 1985)			
14	*See* LA-UR-85-2743	E 1.99: DE85015728	MN -37	10:45044
15	*See* SAND-85-0413C	E 1.99: DE85015495	MN -62a	10:44096
17	*See* LA-UR-85-2485	E 1.99: DE85015704	MN -20f	10:45853
18	*See* SAND-85-0412C	E 1.99: DE85015494	MN -62a	10:44095
CONF-850890-	(International conference on magnetism, San Francisco, CA, USA, 26-30 Aug 1985)			
13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016301	MN -25	10:44592
14	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016303	MN -25	10:44593
15	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017155	MN -34A	10:44594
CONF-8508101-	(11. annual underground coal gasification, Denver, CO, USA, 11-14 Aug 1985)			
1	*See* SAND-85-0879C	E 1.99: DE85017159	MN -90c	10:43637
4	*See* UCRL-93227	E 1.99: DE85017278	MN -90c	10:43671
CONF-8508103-	(Conference on hydraulics and hydrology in the small computer age, Orlando, FL, USA, 13-16 Aug 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016308	MN -11	10:45288
CONF-8508108-	(2. international meeting on metallonthionein, Zurich, Switzerland, 21-24 Aug 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85017303	MN -48	10:45263

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CONF-8508111-	(National conference on energy program evaluation, Chicago, IL, USA, 19-21 Aug 1985)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016296	MN -95d	10:44528
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016475	MN -95d	10:44529
CONF-8508112-	(Tsunami symposium, Victoria, Canada, 6-9 Aug 1985)				
1	*See* LA-UR-85-2412	E 1.99:	DE85015724	MN -11	10:45321
CONF-850902-	(2. international symposium on environmental degradation of materials in nuclear power systems--water reactors, Monterey, CA, USA, 9-12 Sep 1985)				
1	NTIS, PC A02/MF A01 - GPO		TI85014965	MN -78	10:44595
3	NTIS, PC A02/MF A01 - GPO		TI85014974	MN -78	10:44184
CONF-850903-	(International topical meeting on computer applications for nuclear power plant operation and control, Pasco, WA, USA, 8-12 Sep 1985)				
2	NTIS, PC A02; 3		DE85007937	MN -79	10:44310
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009708	MN -79k	10:44254
CONF-850905-	(ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85013848	MN -59B	10:44032
CONF-850912-	(Hydrological applications of supercomputers - future directions, West Lafayette, IN, USA, 10-12 Sep 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016148	MN -11	10:45169
CONF-850926-	(ASME vibration and sound conference, Cincinnati, OH, USA, 10-13 Sep 1985)				
2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85006228	MN -80	10:44255
CONF-850938-	(2. conference on the mechanical behavior of salt, Hannover, F.R. Germany, 24-29 Sep 1985)				
2	*See* SAND-84-1390C	E 1.99:	DE85016195	MN -70	10:43873
CONF-850942-	(190. American Chemical Society national meeting, Chicago, IL, USA, 8-13 Sep 1985)				
11	*See* SAND-85-0920C	E 1.99:	DE85010655	MN -4	10:44783
14	*See* SAND-85-0839C		DE85011518	MN -4	10:44692
CONF-850943-	(5. international conference on heavy metals in the environment, Athens, Greece, 10-13 Sep 1985)				
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017099	MN -11	10:45082
CONF-850952-	(Symposium on tribology, Lyon, France, 3-6 Sep 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85017091	MN -25	10:44665
CONF-850953-	(3. symposium on containment of underground nuclear explosions, Idaho Falls, ID, USA, 10-12 Sep 1985)				
1	*See* SAND-85-0642C	E 1.99:	DE85016998	MN -35	10:45057
2	*See* SAND-85-0785C	E 1.99:	DE85017050	MN -35	10:45058
CONF-850979-	(8. annual gas discharge conference, Oxford, UK, 16-20 Sep 1985)				
2	NTIS, PC A02; 3		DE85017077	MN -34A	10:45349
CONF-850981-	(International symposium on coupled processes affecting the performance of a nuclear waste repository, Berkeley, CA, USA, 18-20 Sep 1985)				
1	*See* SAND-85-0636C	E 1.99:	DE85016456	MN -70B	10:43878
2	*See* SAND-85-0507C	E 1.99:	DE85017118	MN -70	10:43877
CONF-850996-	(29. Human Factors Society annual meeting, Baltimore, MD, USA, 30 Sep-4 Oct 1985)				
2	*See* SAND-85-7201C	E 1.99:	DE85013754	MN -80	10:44429
CONF-8509122-	(U.S.-Japan heat transfer joint seminar, San Diego, CA, USA, 17-20 Sep 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015002	MN -79k	10:44257
CONF-8509129-	(International symposium on fundamentals of rock joints, Bjorkliden, Lapland, Sweden, 15-20 Sep 1985)				
1	*See* SAND-85-0261C	E 1.99:	DE85015147	MN -70	10:43876
2	*See* LA-UR-85-2454	E 1.99:	DE85015714	MN -11	10:45289
CONF-8509130-	(Workshop on real-time computing of the environmental consequences of an accidental release to atmosphere from a nuclear installation, Luxembourg, Luxembourg, 17-20 Sep 1985)				
2	*See* UCRL-93116	E 1.99:	DE85016438	MN -11	10:45131
3	*See* UCRL-92335	E 1.99:	DE85016945	MN -11	10:45130
CONF-8509133-	(International conference on rare earth-development and applications, Beijing, China, 10-14 Sep 1985)				
2	*See* IS-M-541	E 1.99:	DE85015536	MN -25	10:44608
CONF-8509135-	(1022/1032 users conference, Boston, MA, USA, 22-25 Sep 1985)				
2	*See* K/CSD/INF-85-6	E 1.99:	DE85015803	MN -32	10:45927
CONF-8509137-	(2. international symposium on roofing technology, Gaithersburg, MD, USA, 18-20 Sep 1985)				
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CONF-8509140-	(Conference of the ACM SIGUCCS user services "Pulling It All Together", Toledo, OH, USA, 30 Sep-4 Oct 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85014976	MN -32	10:45908

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CONF-8509144-	(14. North American Thermal Analysis Society conference (NATAS), San Francisco, CA, USA, 1 Sep 1985)			
1	*See* LA-UR-85-2373	E 1.99: DE85015671	MN -45	10:45053
CONF-851003-	(Conference on coal science, Sydney, Australia, 28 Oct-1 Nov 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85010650	MN -90d	10:43619
2	*See* SAND-84-2140C	E 1.99: DE85010660	MN -90d	10:43636
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85012375	MN -90a	10:43647
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85013890	MN -90a	10:43648
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85013882	MN -90a	10:43649
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85013846	MN -90a	10:43650
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85014993	MN -90d	10:43620
10	*See* BNL-36713	E 1.99: DE85016055	MN -90	10:43616
CONF-851007-	(3. international meeting on reactor thermal hydraulics, Newport, RI, USA, 15-18 Oct 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005051	MN -79e	10:44256
CONF-851028-	(9. conference on probability and statistics in atmospheric sciences, Virginia Beach, VA, USA, 9-11 Oct 1985)			
1	*See* UCRL-92933	E 1.99: DE85016076	MN -11	10:45078
CONF-851030-	(SOLAR '85, Raleigh, NC, USA, 15-20 Oct 1985)			
1	*See* LA-UR-85-2703	E 1.99: DE85015736	MN -59B	10:44069
CONF-851038-	(DEA-AF-71-F/G-7304 physics of explosives technical meeting, Albuquerque, NM, USA, 17-19 Oct 1985)			
1	*See* SAND-84-1605C	E 1.99: DE85007687	MN -45	10:45055
CONF-851041-	(International meeting on research and test reactor core conversions from HEU to LEU fuels, Argonne, IL, USA, 15-18 Oct 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85007935	MN -80	10:44185
CONF-851042-	(Association for Computing Machinery conference - the range of computing: mid-80's perspective, Denver, CO, USA, 14-16 Oct 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85007988	MN -32	10:45907
CONF-851054-	(Society of Mining Engineers fall meeting, Albuquerque, NM, USA, 16-18 Oct 1985)			
2	*See* UCRL-92395	E 1.99: DE85016436	MN -11	10:43716
CONF-851072-	(Expert systems in government symposium, McLean, VA, USA, 23-25 Oct 1985)			
1	*See* EGG-M-11385	E 1.99: DE85011958	MN -41	10:44345
CONF-8510101-	(Boulder damage symposium, Boulder, CO, USA, 15-17 Oct 1985)			
1	*See* UCRL-91430	E 1.99: DE85013976	MN -25	10:44721
CONF-8510118-	(DOE natural phenomena hazards mitigation conference, Las Vegas, NV, USA, 7-11 Oct 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016959	MN -11	10:45299
3	*See* UCRL-93225	E 1.99: DE85017400	MN -41	10:44910
CONF-851115-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 10-15 Nov 1985)			
3	*See* LA-UR-85-2194	E 1.99: DE85014088	MN -79	10:44860
CONF-860107-	(19. annual Hawaii international conference on system sciences, Honolulu, HI, USA, 8-10 Jan 1986)			
2	*See* UCRL-92706	E 1.99: DE85016286	MN -22	10:43811
CONF-860209-	(27. conference of the Association for Development of Computer Based Instructional Systems, New Orleans, LA, USA, 3-6 Feb 1986)			
1	*See* LA-UR-85-2409	DE85015398	MN -32	10:45915
CONF-860423-	(Radiation Research Society annual meeting, Las Vegas, NV, USA, 13-17 Apr 1986)			
	Radiat. Res., 103: No. 1, 1-33(Jul 1985)			10:45203
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84-02	NTIS (US Sales Only), PC A08/MF A01; 1	DE85750555	MN -63	10:43993
84-04	NTIS (US Sales Only), PC A12/MF A01; 1	DE85752387	MN -63	10:43994
CRREL-				
85-7	*See* AD-A-155083/9/XAB			10:44522
CRREL-SR-				
85-1	*See* AD-A-154364/4/XAB			10:44697
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85-81E	Congressional Research Service, Washington, DC	TI85902103	MN -92	10:43726
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03/ 84	NTIS (US Sales Only), PC A03/MF A01	DE85701993	MN -80	10:45724
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1:1985	*See* PB-85-209187/XAB			10:44549
2:1985	*See* PB-85-199255/XAB			10:44077
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84-01	Naval Civil Engineering Command Lab., Port Hueneme, CA 93043	TI85901527	MN -95d	10:44531
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74-92	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016099	MN -97	10:44169
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85-024	NTIS (US Sales Only), PC A03/MF A01		DE85752093	MN -34D	10:45469
85-025	NTIS (US Sales Only), PC A02/MF A01		DE85752130	MN -34D	10:45470
85-026	NTIS (US Sales Only), PC A02/MF A01		DE85752128	MN -34D	10:45548
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85-031	NTIS (US Sales Only), PC A02/MF A01		DE85752133	MN -34D	10:45550
85-032	NTIS (US Sales Only), PC A03/MF A01		DE85752132	MN -34D	10:45471
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300	Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany, F.R.			ND -34D	10:45460
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80-7-0024	NTIS (US Sales Only), PC A04/MF A01		DE85751283	MN -95d	10:44532
80-7-0025	*See* DGRST-80-7-0024		DE85751283	MN -95d	10:44532
80-7-0125	NTIS (US Sales Only), PC A19/MF A01		DE85751282	MN -62	10:44081
80-7-0173	NTIS (US Sales Only), PC A09; 3		DE85751286	MN -90e	10:43695
81-D-0028	NTIS (US Sales Only), PC A03/MF A01		DE85751280	MN -95d	10:44533
81-D-1238	NTIS (US Sales Only), PC A04/MF A01		DE85751279	MN -97d	10:44156
82-D-0061	NTIS (US Sales Only), PC A02/MF A01		DE85751281	MN -66f	10:44132
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85/ 1	Acid Precip., No. 85/1, vp(15 Jan 1985)				10:45113
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29	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000142	STD -92a	10:43717
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20	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000141	STD -92a	10:43718
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85/ 3	Build. Energy Conserv., No. 85/3, vp(15 Feb 1985)				10:44519
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313	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016232	MN -11	10:45186
314	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016227	MN -11	10:43956
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1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016242	MN -11	10:45191

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DOE/CE/40699- T2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016932	MN -95f	10:44560
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DOE/ER/10822- 3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016730	MN -32	10:45910

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
DOE/ER/10956-18	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016950	MN -25	10:44598
DOE/ER/12061-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016971	MN -34A	10:45743
DOE/ER/13116-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85017062	MN -34A	10:45350
DOE/ER/13272-001	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016808	MN -38	10:44877
DOE/ER/40033-82	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85015292	MN -34B	10:45422
DOE/ER/45116-6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85013238	MN -25	10:44599
DOE/ER/45135-13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016840	MN -34	10:45744
DOE/ER/45144-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016734	MN -34D	10:45551
DOE/ER/60141-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85017357	MN -11	10:45144
DOE/ER/60158-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017188	MN -48	10:45265
DOE/ER/60174-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017233	MN -48	10:45266
DOE/ET/00241-T7	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85014947	MN -93	10:43696
DOE/ET/10069-T114	NTIS (US Sales Only), PC A03/MF A01 (GPO Dep.)	E 1.99: DE85016601	STD -90d	10:43621
DOE/ET/14692-T11	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016115	MN -88	10:43680
DOE/ET/14914-1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE85017046	STD -89	10:43924
DOE/ET/20110-11	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99: DE85015602	STD -59A	10:44061
DOE/ET/20153-80/ 1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85016940	MN -59A	10:43974
82/ 1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85016466	MN -59A	10:43975
DOE/ET/28407-T6	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85016972	MN -66	10:44109
DOE/ET/29032-1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE85016102	MN -97	10:44153
DOE/ET/34006-16	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85014300	STD -78	10:44187
DOE/ET/52040-T22	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85016582	MN -20	10:45841
DOE/ET/53088-172	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85017162	MN -20	10:45779
DOE/EV/04447-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE85013218	MN -92	10:43753
T2	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85013217	MN -92b	10:43754
DOE/EV/06660-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85012409	MN -88	10:43682
DOE/EV/10586-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017126	MN -48	10:45267
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017127	MN -48	10:45268
DOE/FC/10601-1910	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85017933	STD -90d	10:43622
1912	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85017932	STD -90d	10:43623
DOE/FC/10614-1902	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85017289	STD -90b	10:43697
DOE/FE-0037/ 6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85017385	MN -92	10:43742
DOE/FE/00016-T82	NTIS, PC A12/MF A01 (GPO Dep.)	E 1.99: DE85016585	STD -88	10:43683
DOE/FE/60177-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85016579	STD -91	10:43763
DOE/GET-85/ 3	Geotherm. Energy Technol., No. 85/3, vp(15 Feb 1985)			10:44107
DOE/ID/01523-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85015358	STD -66g	10:44133
DOE/ID/01570-T97	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85016661	MN -78	10:44342
DOE/ID/12026-T13	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85016970	MN -66a	10:44110
T14	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85016969	MN -66a	10:44111
DOE/ID/12172-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85017034	STD -66	10:44121
DOE/ID/12422-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85017030	STD -95f	10:43736
DOE/ID/12430-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85017032	STD -95f	10:44741
DOE/ID/12463-1	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE85017031	STD -95f	10:44850

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DOE/ID/12519-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017028	STD -61G	10:43944
DOE/IR/10022-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015219	MN -96	10:44572
DOE/IR/10295-T6	American Association of Community Junior Colleges, One Dupont Circle, NW, Washington, DC 20036		TI85017404	ND -13	10:44571
T7	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85017403	MN -61	10:43945
DOE/JPL/956679-84	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015758	STD -63b	10:43997
DOE/MA-0191	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830 (GPO Dep.)	E 1.99:	TI85016328	STD -13	10:44452
DOE/MC/19205-1814	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE85001981	STD -90a	10:43651
DOE/MC/20212-1877	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016161	STD -93A	10:44516
DOE/MC/20241-1900	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015603	STD -93	10:44468
T12	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015604	STD -93	10:44157
DOE/METC-85/ 5	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99:	DE85001956	MN -90c	10:43624
DOE/MI-0006	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017005	STD -13	10:45895
0006-Vol.2	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE85017006	STD -13	10:45896
DOE/NASA-0200-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017168	MN -60	10:44140
0200-2	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017169	MN -60	10:44141
DOE/NBM-5015227	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015227	MN -95	10:44535
5017015	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE85017015	MN -98	10:44478
5017027	NTIS, PC A10/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE85017027	MN -13	10:45925
DOE/NFC-85/ 1	Nucl. Fuel Cycle, No. 85/1, vp(15 Jan 1985)				10:45930
DOE/OR/00033-T154	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016825	MN -11	10:45087
DOE/OR/20722-58	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017437	MN -11	10:43888
DOE/OR/21363-3	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016914	MN -11	10:45088
DOE/OR/21389-T2	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015215	STD -61A	10:43952
DOE/OR/21400-T100	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015587	MN -25	10:44687
T161	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016544	MN -11	10:45089
T168	NTIS, PC A11/MF A01 (GPO Dep.)	E 1.99:	DE85016177	MN -90h	10:44600
T170	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016180	MN -90e	10:44510
DOE/PC/50270-T8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015584	MN -90b	10:43689
T9	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015585	MN -90b	10:43690
T10	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015582	MN -90b	10:43698
DOE/PC/50800-T11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015595	MN -90a	10:43625
DOE/PC/50807-12	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015816	MN -90a	10:43652
DOE/PC/60017-T1	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016804	STD -90d	10:43626
DOE/PC/60264-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016921	MN -90i	10:43655
DOE/PC/60408-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017295	MN -05	10:44479
T2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85017294	MN -05	10:43699
DOE/PC/60781-7	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015389	MN -90d	10:43627
DOE/PC/70266-1	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016122	STD -90i	10:43656
DOE/PC/70509-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015411	MN -90g	10:44511
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015412	MN -90g	10:44512
DOE/PC/70770-4	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016182	STD -90e	10:43700
DOE/PC/70778-T4	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015498	MN -90a	10:43691
DOE/PC/70779-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015548	MN -90a	10:43628
DOE/PC/70794-3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015388	MN -90e	10:43701
DOE/PC/72007-T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017161	STD -90b	10:43692
DOE/PC/72268-T3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016192	MN -90	10:43706
DOE/PE/70267-T9	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016785	MN -98B	10:44480

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
T10	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016782	MN -98B	10:44481
T11	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016762	MN -98F	10:44482
T12	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016761	MN -98B	10:44483
T13	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016764	MN -98B	10:44484
T14	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016766	MN -05	10:44453
T15	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016767	MN -92	10:43729
T16	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016768	MN -92	10:43730
T17	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016769	MN -98B	10:44485
T18	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016774	MN -98B	10:44486
T20	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85016771	MN -98B	10:44487
T21	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016759	MN -98B	10:44488
T22	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016783	MN -98B	10:44489
T23	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85016781	MN -98B	10:44490
T24	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016776	MN -98B	10:44491
T25	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016772	MN -98B	10:43731
T26	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016773	MN -98B	10:44461
T27	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016758	MN -98B	10:44492
T28	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85016784	MN -98B	10:44493
T29	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016770	MN -98B	10:43732
T30	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016756	MN -98B	10:43733
T31	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016757	MN -98B	10:44494
T32	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016765	MN -05	10:44454
T33	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016763	MN -98B	10:44495
T37	The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036		TI85016743	ND -92	10:43739
T38	Resources for the Future, Inc., 1755 Massachusetts Ave., NW, Washington, DC 20036		TI85016754	ND -98	10:44496
T41	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016755	MN -05	10:45901
T46	The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036		TI85016741	ND -92	10:43734
DOE/PE/70399-					
T7	Woodrow International Center for Scholars, Smithsonian Inst., Bldg. 1000, Jefferson Dr., SW, Washington DC 20560		TI85013139	ND -13	10:44476
DOE/R1/57125-					
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017173	MN -95	10:44536
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017175	MN -95	10:44537
T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017172	MN -95	10:44538
T4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017171	MN -95	10:44539
T15	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017174	MN -95	10:44540
DOE/R2/05273-					
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015626	MN -38	10:44856
DOE/R2/05304-					
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015644	MN -61	10:43928
DOE/R3/06062-					
T1	NTIS MF A01; 2 (GPO Dep.)	E 1.99:	DE85009213	MN -60	10:44142
DOE/R4/10252-					
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016809	MN -95d	10:44541
DOE/R8/03056-					
T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85013339	MN -59A	10:43976
DOE/RA/50421-					
1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016535	MN -97	10:44158
DOE/RG/10312-					
2	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016997	STD -90i	10:43657
DOE/RW-					
0026	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85017061	STD -70	10:43820
DOE/RWM-					
85/ 1	Radioact. Waste Manage. (Oak Ridge, Tenn.), No. 85/1, vp(15 Jan 1985)				10:45931
DOE/SF/00700-					
T10-Vol.1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016501	MN -64	10:44025
T11-Vol.2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016792	MN -64	10:44026
DOE/SF/11504-					
T3-Vol.1	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85014666	STD -59B	10:44062
T3-Vol.2	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85014667	MN -59B	10:44063
DOE-tr-					
273-Vol.3	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE85013333	MN -90g	10:44513
273-Vol.4	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99:	DE85012783	MN -93	10:44514
DP-MS-					
83-50	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016568	MN -15	10:43901
85-25	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016569	MN -23	10:43918
85-34	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015828	MN -11	10:45150
85-62	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017058	MN -61	10:43998
85-68	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017060	MN -11	10:45181
DPS-					
84-03-SEAPS	NTIS (US Sales Only), PC A03/MF A01		DE85751209	MN -70	10:43895
DPST-					
84-851-Vol.2	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85017334	MN -11	10:45192
85-217	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015825	MN -4	10:44774
85-218	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85017043	MN -11	10:45182
85-375	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017042	MN -11	10:45183
DPST-NUREG-					
80-1	*See* NUREG/CR-1645		TI85015957	MN -78	10:44383

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DPSTQA-					
83-4-2-Rev.2	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85017041	MN -2	10:45902
DREO-TN-					
84-33	*See* AD-A-154533/4/XAB				10:45039
DTH-ABK-S-					
19	Denmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner			ND -25	10:44601
37	Denmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner			ND -60	10:44690
8243	NTIS (US Sales Only), PC A03/MF A01; 1		DE85752502	MN -60	10:44143
DTH-AFM-					
83-04	Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik			ND -60	10:44144
83-06	Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik			ND -60	10:44145
83-07	Vandkvalitetsinstituttet, Hoersholm (Denmark)			ND -60	10:44146
DTH-LV-					
144	NTIS (US Sales Only), PC A04/MF A01		DE85752490	MN -95d	10:44542
DTH-LV-MEDD-					
164	NTIS (US Sales Only), PC A05/MF A01		DE85752484	MN -59A	10:44064
166	NTIS (US Sales Only), PC A05/MF A01; 1		DE85752485	MN -94a	10:44444
DTNSRDC/PAS-					
83/ 42	*See* AD-A-154551/6/XAB				10:44887
ECN-					
158	NTIS (US Sales Only), PC A16/MF A01		DE85701980	MN -38	10:44343
161	NTIS (US Sales Only), PC A03/MF A01		DE85702039	MN -32	10:45911
162	NTIS (US Sales Only), PC A05/MF A01		DE85702040	MN -32	10:45842
ECS-SR-					
9-Vol.2	*See* DPST-84-851-Vol.2	E 1.99:	DE85017334	MN -11	10:45192
15	*See* DPST-85-218	E 1.99:	DE85017043	MN -11	10:45182
17	*See* DPST-85-375	E 1.99:	DE85017042	MN -11	10:45183
EEB-L-					
81-04	*See* LBL-19858	E 1.99:	DE85016641	MN -95d	10:45163
84-02	*See* LBL-17444-Rev.	E 1.99:	DE85016483	STD -95d	10:44545
EEB-Vent-					
84-1	*See* LBL-17072-Exc.	E 1.99:	DE85016558	MN -41	10:45098
EGG-					
2020	*See* NUREG/CR-1339		TI85015858	MN -78	10:44305
2060	*See* NUREG/CR-1695		TI85015880	MN -78	10:44385
2388	*See* NUREG/CR-4227		TI85016435	MN -80	10:44312
10282-1078	NTIS, PC A02/MF A01 - GPO (GPO Dep.)	E 1.99:	TI85016907	STD -41	10:45121
10282-2074	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85017163	MN -38	10:44857
EGG/LTR-					
16-13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015849	MN -78	10:44344
20-73	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015850	MN -78	10:44324
112-110-Suppl.1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015449	MN -78	10:44325
126-8	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015433	MN -78	10:44326
EGG-M-					
11385	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85011958	MN -41	10:44345
EGG-MS-					
6852	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016533	MN -90c	10:43629
EGG-PBS-					
6896	NTIS, PC A04 - GPO		DE85017487	MN -78	10:44313
6938	NTIS, PC A04/MF A01 - GPO		TI85017498	MN -78	10:44314
6952	NTIS, PC A03/MF A01 - GPO		TI85017459	MN -78	10:44315
6954	NTIS, PC A04/MF A01 - GPO		TI85017469	MN -78	10:44316
EGG-RE-A-					
77-002	*See* EGG/LTR-20-73	E 1.99:	DE85015850	MN -78	10:44324
78-183	*See* EGG/LTR-16-13	E 1.99:	DE85015849	MN -78	10:44344
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444	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017599	STD -11	10:45145
445	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017227	STD -11	10:45123
EMS-NP-					
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EPA-					
450/ 3-84/ 010	*See* PB-85-205144/XAB				10:45103
600/ 3-85/ 022	*See* PB-85-203107/XAB				10:44176
600/ 7-79-159	*See* PB-80124837				10:43670
600/ 9-80-050	*See* PB-81126443				10:45110
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600/ D-85/ 111	*See* PB-85-201150/XAB				10:45102
600/ S7-82-065a-Vol.1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016812	MN -90i	10:43665
600/ S7-82-065b-Vol.2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016813	MN -90i	10:43664
660/ 3-74-020	*See* PB-238355				10:45173
906/ 9-85/ 001	*See* PB-85-206258/XAB				10:43669
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3-73-032	GPO*				10:43666
EPRI-AP-					
3348-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920815	ND -90f	10:43766
3963	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI85920830	ND -60	10:44147

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4063	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920806	ND -93	10:43702
4176	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920838	ND -90d	10:43630
4194	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920855	ND -93	10:44160
4198	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920854	ND -66f	10:44134
4214	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920853	ND -66	10:44136
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3623	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920768	ND -90e	10:44161
4001	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920224	ND -90h	10:44162
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4035	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920819	ND -90d	10:43658
4153	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920851	ND -90i	10:43659
4155	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920792	ND -90	10:44163
4164-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920809	ND -95e	10:43954
4175	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920789	ND -11	10:45137
4204	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920835	ND -90h	10:44164
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4104	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920731	ND -97	10:45282
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3757	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920848	ND -90i	10:45090
4079-CCM	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920849	ND -13	10:44503
4159	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920810	ND -11	10:45280
4165	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920797	ND -11	10:45091
4189	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE85016798	MN -48	10:45281
4190	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920796	ND -11	10:45092
4203	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920811	ND -11	10:45271
4205	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920837	ND -97c	10:44504
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3990	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920828	ND -97a	10:44154
3996	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920826	ND -97a	10:44177
4042	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920822	ND -97a	10:44178
4181	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920812	ND -97a	10:44706
4188	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920802	ND -97a	10:44179
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4174	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920841	ND -97e	10:44505
4179	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920807	ND -97d	10:44517
4200	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920798	ND -94ca	10:44165
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3835	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920782	ND -78	10:44346
4037	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920831	ND -70B	10:43858
4061M	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920833	ND -78	10:44230
4069M	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920820	ND -80	10:44290
4141	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920800	ND -80	10:44180
4169	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920788	ND -78	10:44210

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83043	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE85014778	MN -59A	10:44065
EUR-					
8206-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -63	10:43999
8869	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			ND -94a	10:44101
8924-EN	*See* PB-85-192896/XAB				10:44567
8925	Commission of the European Communities, Luxembourg			ND -66a	10:45093
8953-DE-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -95d	10:44543
8996-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -60	10:44148
9011-EN	*See* PB-85-189587/XAB				10:44471
9037	Commission of the European Communities, Luxembourg			ND -80	10:44327
9117	Commission of the European Communities, Luxembourg			ND -95d	10:44563
9122-DE-EN	*See* PB-85-200913/XAB				10:43632
9134-EN	*See* PB-85-194017/XAB				10:44826
9142-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -62	10:44084
9143/ II-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -59A	10:44066
9144-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -62	10:44102
9213-EN	*See* PB-85-190627/XAB				10:45124
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9233-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -62	10:44085
9274-EN	*See* PB-85-192862/XAB				10:44004
9282-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -32	10:44086
9331-EN	*See* PB-85-195188/XAB				10:44005
9673-EN/ I	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -11	10:45074
9678-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -11	10:45075
9719-EN	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -59A	10:44067
9748-FR	Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities			ND -61A	10:43929
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2893-155	*See* DOE/ET/10069-T114	E 1.99:	DE85016601	STD -90d	10:43621
FEI-					
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FERC-					
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85017069	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017069	MN -92	10:43756
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FNAL-TM-					
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1318	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016990	STD -28	10:44947
1319	NTIS, PC A02; 3		DE85016983	STD -28	10:44973
1320	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016991	STD -28	10:44974
1321	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016993	STD -28	10:44948
1322	NTIS, PC A02; 3		DE85016985	STD -28	10:44975
1323	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016984	STD -28	10:45912
1331	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016988	STD -28	10:44949
1332	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016994	STD -28	10:44976
1333	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016992	STD -28	10:44950
1336	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016995	STD -28	10:44951

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FRNC-TH-				
1183	NTIS (US Sales Only), PC A12/MF A01	DE85751204	MN -34C	10:45617
1462	NTIS (US Sales Only), PC A09/MF A01	DE85751176	MN -37	10:45043
1546	NTIS (US Sales Only), PC A07/MF A01	DE85750554	MN -58	10:43977
1550	NTIS (US Sales Only), PC A05/MF A01	DE85750556	MN -59A	10:44068
1563	NTIS (US Sales Only), PC A06/MF A01	DE85750553	MN -94a	10:44103
1564	NTIS (US Sales Only), PC A07/MF A01	DE85751175	MN -34C	10:45351
1565	NTIS (US Sales Only), PC A05/MF A01	DE85751011	MN -92	10:43747
1567	NTIS (US Sales Only), PC A09/MF A01	DE85750551	MN -63	10:44087
1569	NTIS (US Sales Only), PC A06/MF A01	DE85751150	MN -34D	10:45552
1577	NTIS (US Sales Only), PC A07/MF A01	DE85750552	MN -63	10:44000
1584	NTIS (US Sales Only), PC A06/MF A01	DE85750557	MN -4	10:44851
1595	NTIS (US Sales Only), PC A08/MF A01	DE85750695	MN -62	10:44088
1614	NTIS (US Sales Only), PC A11/MF A01	DE85751157	MN -25	10:44707
1621	NTIS (US Sales Only), PC A05/MF A01	DE85751205	MN -48	10:45208
1626	NTIS (US Sales Only), PC A08/MF A01	DE85751186	MN -34B	10:45341
1766	NTIS (US Sales Only), PC A09/MF A01	DE85752051	MN -34A	10:45352
1768	NTIS (US Sales Only), PC A14/MF A01	DE85751178	MN -34B	10:45342
1770	NTIS (US Sales Only), PC A07/MF A01	DE85751180	MN -20f	10:45353
1775	NTIS (US Sales Only), PC A22; 3	DE85751287	MN -4	10:44825
1818	NTIS (US Sales Only), PC A10/MF A01	DE85751179	MN -34B	10:45326
1820	NTIS (US Sales Only), PC A07/MF A01	DE85751190	MN -48	10:45218
1821	NTIS (US Sales Only), PC A07/MF A01	DE85751174	MN -48	10:45201
1876	NTIS (US Sales Only), PC A05/MF A01	DE85751156	MN -70	10:43821
1879	NTIS (US Sales Only), PC A05/MF A01	DE85751189	MN -47	10:43806
1899	NTIS (US Sales Only), PC A09/MF A01	DE85751173	MN -48	10:45738
1901	NTIS (US Sales Only), PC A06/MF A01	DE85751172	MN -37	10:45015
1903	NTIS (US Sales Only), PC A11/MF A01	DE85751274	MN -62	10:44104
1904	NTIS (US Sales Only), PC A09/MF A01	DE85751275	MN -60	10:44149
1909	NTIS (US Sales Only), PC A08/MF A01	DE85751276	MN -94a	10:44105
1910	NTIS (US Sales Only), PC A07/MF A01	DE85751278	MN -63	10:44001
1911	NTIS (US Sales Only), PC A07/MF A01	DE85751277	MN -62	10:44089
1917	NTIS (US Sales Only), PC A07/MF A01	DE85752046	MN -28	10:44952
1922	NTIS (US Sales Only), PC A06/MF A01	DE85752043	MN -34B	10:45343
1931	NTIS (US Sales Only), PC A08/MF A01; 1	DE85752374	MN -93	10:44544
1932	NTIS (US Sales Only), PC A14/MF A01	DE85751284	MN -62	10:44106
1971	NTIS (US Sales Only), PC A09/MF A01	DE85752048	MN -38	10:44858
1978	NTIS (US Sales Only), PC A08/MF A01; 1	DE85752372	MN -62	10:44090
2010	NTIS (US Sales Only), PC A07/MF A01; 1	DE85752375	MN -63	10:44002
2013	NTIS (US Sales Only), PC A10/MF A01	DE85752047	MN -48	10:45016
2024	NTIS (US Sales Only), PC A09/MF A01; 1	DE85752386	MN -92	10:43743
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83-31-AKA	NTIS (US Sales Only), PC A02/MF A01	DE85751869	MN -41	10:45739
FWS/OBS-				
82/ 11.27	NTIS, PC A03/MF A01	DE85901730	MN -11	10:45161
GANIL-A-				
84-01	NTIS (US Sales Only), PC A03/MF A01	DE85751183	MN -28	10:44932
GANIL-P-				
84-01	NTIS (US Sales Only), PC A03/MF A01	DE85751182	MN -34C	10:45597
84-07	NTIS (US Sales Only), PC A03/MF A01	DE85751164	MN -34C	10:45680
GAO/RCED-				
85-115	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877	TI85901760	MN -92	10:43744
GCA-TR-				
80-27-G(I)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85016811	MN -11	10:43660
GKSS-				
85/ E/ 3	NTIS (US Sales Only), PC A10/MF A01	DE85751898	MN -11	10:45172
85/ E/ 5	NTIS (US Sales Only), PC A02/MF A01	DE85752088	MN -37	10:45050
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138	NTIS (US Sales Only), PC A04/MF A01	DE85751872	MN -80	10:44355
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360	NTIS (US Sales Only), PC A03/MF A01	DE85701960	MN -48	10:45146
GSF-OE-				
820	NTIS (US Sales Only), PC A04/MF A01; 1	DE85752672	MN -11	10:45094
GSF-S-				
1037	NTIS (US Sales Only), PC A03/MF A01	DE85751880	MN -48	10:45202
GSI-				
85-1-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751870	MN -34A	10:45354
85-2	NTIS (US Sales Only), PC A05/MF A01	DE85751888	MN -34C	10:45629
85-3	NTIS (US Sales Only), PC A07/MF A01	DE85752094	MN -48	10:45219
85-4-Prepr.	NTIS (US Sales Only), PC A03/MF A01	DE85751893	MN -34C	10:45681
85-5-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751889	MN -34C	10:45682
85-6-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751890	MN -34C	10:45683
85-7-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751912	MN -34C	10:45686
85-8	NTIS (US Sales Only), PC A05/MF A01	DE85752100	MN -34C	10:45630
85-8-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751885	MN -48	10:45220
85-9	NTIS (US Sales Only), PC A06/MF A01	DE85752135	MN -34D	10:45598
85-9-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751892	MN -34C	10:45687
85-10-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751895	MN -34C	10:45666
85-11-Prepr.	NTIS (US Sales Only), PC A03/MF A01	DE85751896	MN -34C	10:45621
85-12-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE85751897	MN -34C	10:45631

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SA-3237	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85013748	MN -79a	10:44259
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3301-FP	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85013745	MN -71	10:43822
HEDL-TME-					
80-17	*See* NUREG/CR-1382		TI85015876	MN -78	10:44329
HMI-P-					
6/ 84-HF	NTIS (US Sales Only), PC A04/MF A01		DE85752206	MN -34C	10:45660
IAE-					
3755/ 2	NTIS (US Sales Only), PC A03/MF A01		DE85701846	MN -34C	10:45618
3756/ 2	NTIS (US Sales Only), PC A03/MF A01		DE85701817	MN -34C	10:45599
3824/ 2	NTIS (US Sales Only), PC A02/MF A01		DE85701835	MN -34C	10:45668
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2866-F	NTIS (US Sales Only), PC A05/MF A01		DE85701952	MN -11	10:45133
IAEA-TECDOC-					
322	NTIS (US Sales Only), PC A12/MF A01		DE85781532	MN -51	10:43793
326	NTIS (US Sales Only), PC A04/MF A01		DE85781533	MN -48	10:45227
327	NTIS (US Sales Only), PC A05/MF A01		DE85701953	MN -51	10:43794
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15	NTIS (US Sales Only), PC A15/MF A01		DE85702032	MN -70	10:43859
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84/ 147	NTIS (US Sales Only), PC A02/MF A01		DE85701923	MN -34A	10:45754
84/ 148	NTIS (US Sales Only), PC A02/MF A01		DE85701912	MN -34D	10:45771
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31-548	NTIS (US Sales Only), PC A08/MF A01; 1		DE85750564	MN -4	10:44800
32-225	NTIS (US Sales Only), PC A11/MF A01; 1		DE85752373	MN -90e	10:44775
IFSR-					
172	*See* DOE/ET/53088-172	E 1.99:	DE85017162	MN -20	10:43779
IFVE-ORI-OEF-					
84-36	NTIS (US Sales Only), PC A02/MF A01		DE85701847	MN -34C	10:45622
IKE-					
2-68	NTIS (US Sales Only), PC A07/MF A01		DE85751884	MN -78	10:44356
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84-121	*See* PB-85-193787/XAB				10:43685
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83/ L	*See* NEANDC(J)-96/U		DE84900755	MN -34C	10:45678
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155/ G-P-No.10	NTIS (US Sales Only), PC A04/MF A01		DE85701685	MN -2	10:45572
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0096	NTIS (US Sales Only), PC A04/MF A01		DE85701950	MN -51	10:45147
0098	NTIS (US Sales Only), PC A03/MF A01		DE85701970	MN -41	10:45229
0099	NTIS (US Sales Only), PC A02/MF A01		DE85702036	MN -2	10:43860
0101	NTIS (US Sales Only), PC A04/MF A01		DE85701971	MN -41	10:45740
0102-1	NTIS (US Sales Only), PC A06/MF A01		DE85701972	MN -22	10:43914
0102-2	NTIS (US Sales Only), PC A10/MF A01		DE85701973	MN -22	10:43915
0102-3	NTIS (US Sales Only), PC A06/MF A01		DE85701974	MN -22	10:43916
0104	NTIS (US Sales Only), PC A03/MF A01		DE85701962	MN -41	10:44358
0105	NTIS (US Sales Only), PC A14/MF A01		DE85701951	MN -51	10:45176
0119	NTIS (US Sales Only), PC A03/MF A01		DE85701939	MN -4	10:44742
INIS-mf-					
9306	NTIS (US Sales Only), PC A20/MF A01		DE85781517	MN -34D	10:45573
9319	NTIS (US Sales Only), PC A06/MF A01		DE85781550	MN -34C	10:45574
9320	NTIS (US Sales Only), PC A09/MF A01		DE85781554	MN -25	10:44667
9323	NTIS (US Sales Only), PC A03/MF A01		DE85781555	MN -25	10:44604
9334	NTIS (US Sales Only), PC A02/MF A01		DE85781558	MN -48	10:45230
9335	NTIS (US Sales Only), PC A05/MF A01		DE85781549	MN -34C	10:45701
9337	NTIS (US Sales Only), PC A11/MF A01		DE85781551	MN -4	10:44743
9340	NTIS (US Sales Only), PC A04/MF A01		DE85781568	MN -48	10:45231
9342	NTIS (US Sales Only), PC A15/MF A01		DE85781548	MN -34D	10:45442
9489	NTIS (US Sales Only), PC A22/MF A01		DE85781516	MN -34D	10:45535
9524	NTIS (US Sales Only), PC A04/MF A01		DE85781030	MN -4	10:43889
9695	NTIS (US Sales Only), PC A02/MF A01		DE85701818	MN -34C	10:45632
9697	NTIS (US Sales Only), PC A02/MF A01		DE85701811	MN -34C	10:45702
9698	NTIS (US Sales Only), PC A02/MF A01		DE85701935	MN -34C	10:45623
9699	NTIS (US Sales Only), PC A02/MF A01		DE85701937	MN -34C	10:45624
9700	NTIS (US Sales Only), PC A02/MF A01		DE85701857	MN -4	10:44744
9701	NTIS (US Sales Only), PC A02/MF A01		DE85701819	MN -34C	10:45625
9707	NTIS (US Sales Only), PC A03/MF A01		DE85701820	MN -34C	10:45703
9711	NTIS (US Sales Only), PC A05/MF A01		DE85781556	MN -51	10:44359
9740	NTIS (US Sales Only), PC A11/MF A01		DE85781539	MN -34A	10:44777
9744	NTIS (US Sales Only), PC A09/MF A01		DE85781545	MN -34B	10:45327
9745	NTIS (US Sales Only), PC A08/MF A01		DE85781547	MN -93	10:44515
9746	NTIS (US Sales Only), PC A13/MF A01		DE85781542	MN -20	10:45780
9747	NTIS (US Sales Only), PC A08/MF A01		DE85781540	MN -20	10:45781
9748	NTIS (US Sales Only), PC A07/MF A01		DE85781536	MN -34A	10:45384
9749	NTIS (US Sales Only), PC A09/MF A01		DE85781544	MN -20	10:45846
9750	NTIS (US Sales Only), PC A06/MF A01		DE85781537	MN -34A	10:45385
9751	NTIS (US Sales Only), PC A06/MF A01		DE85781553	MN -4	10:44607
9752	NTIS (US Sales Only), PC A08/MF A01		DE85781546	MN -34B	10:45328
9753	NTIS (US Sales Only), PC A08/MF A01		DE85781538	MN -34A	10:45452

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9754	NTIS (US Sales Only), PC A06/MF A01	DE85781541	MN -20	10:45782
9755	NTIS (US Sales Only), PC A05/MF A01	DE85781543	MN -20	10:45783
9756	NTIS (US Sales Only), PC A05/MF A01	DE85781535	MN -34D	10:45560
INP-				
1131/ PL	NTIS (US Sales Only), PC A02/MF A01	DE85701936	MN -34C	10:45536
IPEN-Inf-				
16	NTIS (US Sales Only), PC A02/MF A01	DE85701988	MN -25	10:44328
17	NTIS (US Sales Only), PC A02/MF A01	DE85702041	MN -32	10:44284
IPEN-Pub-				
60	NTIS (US Sales Only), PC A02/MF A01	DE85701940	MN -4	10:44746
61	NTIS (US Sales Only), PC A02/MF A01	DE85781552	MN -4	10:44747
IPNO-DRE-				
84-02	NTIS (US Sales Only), PC A05/MF A01	DE85752052	MN -34	10:44668
84-20	NTIS (US Sales Only), PC A02/MF A01	DE85752037	MN -34C	10:45602
84-33	NTIS (US Sales Only), PC A03/MF A01	DE85752038	MN -34C	10:45633
84-34	NTIS (US Sales Only), PC A03/MF A01	DE85752040	MN -34C	10:45661
IPNO-GEPL-				
83-03	NTIS (US Sales Only), PC A03/MF A01	DE85751210	MN -28	10:44977
83-10	NTIS (US Sales Only), PC A02/MF A01	DE85751214	MN -37	10:45018
IPNO-RA-				
1983	NTIS (US Sales Only), PC A10/MF A01	DE85751177	MN -34C	10:45575
IPNO-T-				
83-03	NTIS (US Sales Only), PC A05/MF A01	DE85751213	MN -4	10:44844
IPNO-TH-				
83-32	NTIS (US Sales Only), PC A02/MF A01	DE85751161	MN -34C	10:45704
83-34	NTIS (US Sales Only), PC A02/MF A01	DE85751162	MN -34D	10:45537
83-35	NTIS (US Sales Only), PC A02/MF A01	DE85751163	MN -34C	10:45507
83-54	NTIS (US Sales Only), PC A02/MF A01	DE85751160	MN -34C	10:45561
84-15	NTIS (US Sales Only), PC A07/MF A01	DE85751171	MN -34D	10:45538
84-39	NTIS (US Sales Only), PC A04/MF A01	DE85751192	MN -34D	10:45756
IPP-				
2/ 273	NTIS (US Sales Only), PC A06/MF A01	DE85751879	MN -20d	10:45847
6/ 236	NTIS (US Sales Only), PC A03/MF A01	DE85751878	MN -32	10:45913
6-245	NTIS (US Sales Only), PC A05/MF A01	DE85752082	MN -20d	10:45848
IS-				
4862	*See* NUREG/CR-3952	TI85011358	MN -78	10:44238
IS-M-				
541	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85015536	MN -25	10:44608
544	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85015513	MN -90a	10:43653
547	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85015522	MN -4	10:44778
IS-T-				
1212	NTIS, PC A10/MF A01 (GPO Dep.)	E 1.99: DE85015562	MN -4	10:44804
ISN-				
83-02	NTIS (US Sales Only), PC A03/MF A01	DE85751211	MN -34C	10:45705
84-24	NTIS (US Sales Only), PC A02/MF A01	DE85751212	MN -34C	10:45603
ITF-				
84-63-R	NTIS (US Sales Only), PC A02/MF A01	DE85701812	MN -34C	10:45587
84-64-R	NTIS (US Sales Only), PC A02/MF A01	DE85701813	MN -34C	10:45706
84-67-R	NTIS (US Sales Only), PC A03/MF A01	DE85701821	MN -34C	10:45588
ITP-				
84-53-E	NTIS (US Sales Only), PC A02/MF A01	DE85701822	MN -34C	10:45611
84-86-E	NTIS (US Sales Only), PC A02/MF A01	DE85701814	MN -34C	10:45589
IVL-B-				
516	Swedish Water and Air Pollution Research Lab., Goeteborg			10:45095
545	Swedish Water and Air Pollution Research Lab., Goeteborg		ND -11	10:45096
IWGFR-				
49-Vol.2	NTIS (US Sales Only), PC A99/MF A01	DE85781531	MN -25	10:44633
JAERI-M-				
83-229	NTIS (US Sales Only), PC A04/MF A01	DE85701862	MN -4	10:44836
83-236	*See* NEANDC(J)-96/U	DE84900755	MN -34C	10:45678
83-241	NTIS (US Sales Only), PC A04/MF A01	DE85701858	MN -4	10:44634
84-059	NTIS (US Sales Only), PC A03/MF A01	DE85701859	MN -4	10:44779
84-060	NTIS (US Sales Only), PC A03/MF A01	DE85701860	MN -4	10:44780
JINR-				
1-84-491	NTIS (US Sales Only), PC A02/MF A01	DE85701840	MN -34C	10:45605
1-84-519	NTIS (US Sales Only), PC A02/MF A01	DE85701843	MN -34C	10:45590
6-84-96	NTIS (US Sales Only), PC A02/MF A01	DE85701854	MN -34C	10:45638
6-84-220	NTIS (US Sales Only), PC A02/MF A01	DE85701852	MN -34C	10:45639
6-84-388	NTIS (US Sales Only), PC A02/MF A01	DE85701853	MN -34C	10:45640
18-83-468	NTIS (US Sales Only), PC A02/MF A01	DE85701864	MN -25	10:44691
19-84-544	NTIS (US Sales Only), PC A02/MF A01	DE85701871	MN -48	10:45232
E-1-83-690	NTIS (US Sales Only), PC A02/MF A01	DE85701841	MN -34C	10:45591
E-1-83-854	NTIS (US Sales Only), PC A02/MF A01	DE85701823	MN -34C	10:45592
E-1-84-26	NTIS (US Sales Only), PC A02/MF A01	DE85701824	MN -34C	10:45593
E-1-84-411	NTIS (US Sales Only), PC A02/MF A01	DE85701838	MN -34C	10:45643
E-1-84-492	NTIS (US Sales Only), PC A02/MF A01	DE85701844	MN -34C	10:45606
E-2-84-260	NTIS (US Sales Only), PC A02/MF A01	DE85701919	MN -34D	10:45562
E-4-84-72	NTIS (US Sales Only), PC A02/MF A01	DE85701828	MN -34C	10:45644
E-4-84-305	NTIS (US Sales Only), PC A02/MF A01	DE85701842	MN -34C	10:45645
E-4-84-377	NTIS (US Sales Only), PC A02/MF A01	DE85701825	MN -34C	10:45646
E-4-84-446	NTIS (US Sales Only), PC A05/MF A01	DE85701836	MN -34C	10:45675
E-4-84-456	NTIS (US Sales Only), PC A02/MF A01	DE85701826	MN -34C	10:45607

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E-4-84-487	NTIS (US Sales Only), PC A02/MF A01		DE85701827	MN -34C	10:45707
E-7-84-415	NTIS (US Sales Only), PC A02/MF A01		DE85701829	MN -34C	10:45708
R-1-83-853	NTIS (US Sales Only), PC A02/MF A01		DE85701830	MN -34C	10:45594
R-1-84-532	NTIS (US Sales Only), PC A02/MF A01		DE85701845	MN -34C	10:45614
R-1-84-552	NTIS (US Sales Only), PC A02/MF A01		DE85701855	MN -34C	10:45662
R-2-84-250	NTIS (US Sales Only), PC A02/MF A01		DE85701913	MN -34D	10:45772
R-3-84-42	NTIS (US Sales Only), PC A02/MF A01		DE85701848	MN -34C	10:45647
R-3-84-668	NTIS (US Sales Only), PC A02/MF A01		DE85701849	MN -34C	10:45648
R-3-84-669	NTIS (US Sales Only), PC A02/MF A01		DE85701850	MN -34C	10:45649
R-4-84-18	NTIS (US Sales Only), PC A02/MF A01		DE85701831	MN -34C	10:45595
R-4-84-32	NTIS (US Sales Only), PC A02/MF A01		DE85701815	MN -34C	10:45619
R-4-84-45	NTIS (US Sales Only), PC A02/MF A01		DE85701834	MN -34C	10:45596
R-4-84-326	NTIS (US Sales Only), PC A02/MF A01		DE85701837	MN -34C	10:45676
R-4-84-355	NTIS (US Sales Only), PC A02/MF A01		DE85701832	MN -34C	10:45655
R-4-84-443	NTIS (US Sales Only), PC A02/MF A01		DE85701833	MN -34C	10:45608
R-4-84-475	NTIS (US Sales Only), PC A02/MF A01		DE85701816	MN -34C	10:45656
R-6-84-66	NTIS (US Sales Only), PC A02/MF A01		DE85701851	MN -34C	10:45650
R-6-84-422	NTIS (US Sales Only), PC A02/MF A01		DE85701839	MN -34C	10:45677
R-19-84-645	NTIS (US Sales Only), PC A02/MF A01		DE85701869	MN -48	10:45233
R-19-84-667	NTIS (US Sales Only), PC A02/MF A01		DE85701870	MN -48	10:45234
JPL-					
5101-66	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85015766	MN -63b	10:44003
Juel-					
1949	NTIS (US Sales Only), PC A17/MF A01		DE85751871	MN -11	10:45097
1958	NTIS (US Sales Only), PC A08/MF A01		DE85752095	MN -48	10:45212
1961	NTIS (US Sales Only), PC A09/MF A01		DE85751883	MN -77	10:44281
Juel-Conf-					
49	Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)			ND -25	10:44713
Juel-Spez-					
277	NTIS (US Sales Only), PC A04/MF A01		DE85751876	MN -38	10:44900
280	NTIS (US Sales Only), PC A09/MF A01		DE85751877	MN -34C	10:45663
K-					
2055	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016924	STD -22	10:43809
K/CSD/INF-					
85-6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015803	MN -32	10:45927
K/OA-					
5929	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015802	MN -15	10:43902
K/PS-					
1096	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017249	MN -4	10:43810
5048	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016250	MN -4	10:44781
KA-THEP-					
84-6	*See* LAPP-TH-113		DE85751146	MN -34	10:45758
KFK-					
3518	NTIS (US Sales Only), PC A03/MF A01		DE85751899	MN -38	10:44859
3557	NTIS (US Sales Only), PC A05/MF A01		DE85752125	MN -78	10:44360
3681-B	NTIS (US Sales Only), PC A02/MF A01		DE85751894	MN -38	10:44912
3763	NTIS (US Sales Only), PC A09/MF A01		DE85751881	MN -79	10:44270
3778	NTIS (US Sales Only), PC A03/MF A01		DE85751907	MN -80	10:44317
3808	Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)			ND -25	10:44635
3812	NTIS (US Sales Only), PC A03/MF A01		DE85752101	MN -34C	10:45725
3813	NTIS (US Sales Only), PC A04/MF A01		DE85751903	MN -38	10:44896
3818	NTIS (US Sales Only), PC A05/MF A01		DE85751902	MN -38	10:44304
3828	NTIS (US Sales Only), PC A03/MF A01		DE85751873	MN -79p	10:44361
3830	NTIS (US Sales Only), PC A03/MF A01		DE85751908	MN -11	10:44748
3834	NTIS (US Sales Only), PC A03/MF A01		DE85751900	MN -20d	10:45849
3838	NTIS (US Sales Only), PC A04/MF A01		DE85751906	MN -79	10:44285
3847	NTIS (US Sales Only), PC A05/MF A01		DE85752096	MN -79p	10:44362
3853	NTIS (US Sales Only), PC A07/MF A01		DE85751911	MN -86	10:44845
3856	NTIS (US Sales Only), PC A03/MF A01		DE85751909	MN -80	10:44363
3860	NTIS (US Sales Only), PC A14/MF A01		DE85751905	MN -79	10:45914
3861	NTIS (US Sales Only), PC A07/MF A01		DE85751882	MN -78	10:44364
3862	NTIS (US Sales Only), PC A07/MF A01		DE85751901	MN -78	10:44365
3864	NTIS (US Sales Only), PC A06/MF A01		DE85751910	MN -78	10:44231
3872	NTIS (US Sales Only), PC A04/MF A01		DE85751886	MN -79p	10:44366
3876	NTIS (US Sales Only), PC A07/MF A01		DE85752136	MN -38	10:44897
3880/ 1	INIS Clearinghouse as microfiche KFK--3880/1			ND -79p	10:44367
3881	NTIS (US Sales Only), PC A10/MF A01; 1		DE85752674	MN -13	10:44455
3909	NTIS (US Sales Only), PC A02/MF A01		DE85752098	MN -48	10:44749
LA-					
8427-MS	*See* NUREG/CR-1567		TI85015901	MN -78	10:44381
8702-MS	*See* NUREG/CR-1946		TI85015980	MN -78	10:44397
8704-MS	*See* NUREG/CR-1944		TI85015979	MN -78	10:44396
8709-MS	*See* NUREG/CR-2054		TI85015981	MN -78	10:44403
8741-MS	*See* NUREG/CR-1991		TI85015982	MN -78	10:44399
10319-MS	*See* NUREG/CR-4107		TI85016543	MN -15	10:43908
10417-MS	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016211	STD -4	10:44846
10438-C	NTIS, PC A18/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016203	STD -34C	10:45709
10442-MS	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016218	STD -48	10:45199
LA-tr-					
85-37	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017024	MN -25	10:44696
LA-UR-					
85-990	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85009637	MN -48	10:45196

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85-1627	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015689	MN -28	10:44954
85-2077	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85014112	MN -21	10:45850
85-2161	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85014098	MN -34C	10:45582
85-2194	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85014088	MN -79	10:44860
85-2245	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85014078	MN -21	10:45851
85-2329	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015683	MN -32	10:45928
85-2330	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015682	MN -34A	10:44750
85-2351	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015677	MN -21	10:45852
85-2368	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015672	MN -48	10:45207
85-2373	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015671	MN -45	10:45053
85-2375	NTIS, PC A03; 3		DE85015670	MN -4	10:44805
85-2380	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015668	MN -38	10:44878
85-2398	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015667	MN -15	10:43903
85-2409	NTIS, PC A02; 3		DE85015398	MN -32	10:45915
85-2410	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015725	MN -4	10:44806
85-2412	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015724	MN -11	10:45321
85-2417	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015722	MN -15	10:43904
85-2422	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015721	MN -34C	10:45583
85-2440	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015718	MN -25	10:44717
85-2454	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015714	MN -11	10:45289
85-2457	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015713	MN -34B	10:45329
85-2479	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015707	MN -34	10:45916
85-2481	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015705	MN -25	10:44636
85-2485	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015704	MN -20f	10:45853
85-2504	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015702	MN -34	10:45745
85-2515	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015700	MN -25	10:44637
85-2556	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015694	MN -28	10:44955
85-2566	NTIS, PC A02; 3		DE85015692	MN -15	10:43905
85-2567	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015752	MN -15	10:43906
85-2595	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015747	MN -28	10:45394
85-2596	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015746	MN -28	10:45395
85-2648	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015744	MN -33	10:44273
85-2703	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015736	MN -59B	10:44069
85-2736	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015730	MN -15	10:43907
85-2740	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85015729	MN -13	10:45897
85-2743	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015728	MN -37	10:45044
LAL-					
84-01	NTIS (US Sales Only), PC A12/MF A01		DE85751181	MN -37	10:45019
LAPP-T-					
84-02	NTIS (US Sales Only), PC A07/MF A01		DE85752066	MN -34D	10:45453
LAPP-TH-					
82	NTIS (US Sales Only), PC A02/MF A01		DE85751166	MN -34D	10:45508
85	NTIS (US Sales Only), PC A03/MF A01		DE85752050	MN -34B	10:45330
99	NTIS (US Sales Only), PC A02/MF A01		DE85752044	MN -34B	10:45331
100	NTIS (US Sales Only), PC A02/MF A01		DE85751165	MN -34D	10:45509
103	NTIS (US Sales Only), PC A02/MF A01		DE85751193	MN -34	10:45773
108	NTIS (US Sales Only), PC A03/MF A01		DE85751147	MN -34C	10:45757
113	NTIS (US Sales Only), PC A02/MF A01		DE85751146	MN -34	10:45758
114	NTIS (US Sales Only), PC A02/MF A01		DE85751148	MN -34	10:45759
116	NTIS (US Sales Only), PC A02/MF A01		DE85752041	MN -34D	10:45510
LBL-					
91-Rev.-Suppl.	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016498	MN -34D	10:45020
16993-Rev.	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85016571	MN -34D	10:45917
17071	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85016491	MN -62	10:44070
17072-Exc.	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016558	MN -41	10:45098
17444-Rev.	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99:	DE85016483	STD -95d	10:44545
17827-Rev.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016644	MN -28	10:45396
17947	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016560	MN -34	10:45409
18587	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016555	MN -70	10:43890
18755	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016495	STD -95d	10:44546
18797	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016559	MN -28	10:44956
19102	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016550	MN -62	10:44091
19230	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016486	STD -32	10:45918
19235	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016570	MN -25	10:44638
19326	NTIS, PC A02; 3 (GPO Dep.)	E 1.99:	DE85016509	STD -38	10:44913
19483	NTIS, PC A02/MF A01; 1		DE85016637	MN -28	10:44957
19486	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016556	MN -28	10:45002
19487	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016628	MN -28	10:44978
19488	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016563	MN -28	10:45003
19501	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017257	STD -21	10:45854
19527	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016561	MN -28	10:44958
19529	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016564	MN -21	10:45855
19560	NTIS, PC A02; 3		DE85016554	MN -28	10:44959
19561	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016634	MN -28	10:44979
19584	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016635	MN -28	10:44980
19620	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016626	MN -28	10:44933
19647	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016636	MN -21	10:45856
19727	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85016512	STD -94c	10:44447
19798	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016566	MN -28	10:44960
19842	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016548	MN -62	10:44092
19854	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016629	MN -4	10:45397
19858	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85016641	MN -95d	10:45163
19886	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99:	DE85016526	MN -4	10:44807

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
LBL-PUB-					
3052	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016421	MN -32	10:45919
LCC-					
016/ 84	NTIS (US Sales Only), PC A02/MF A01		DE85701981	MN -38	10:44861
LITH-IKP-R-					
334	NTIS (US Sales Only), PC A04/MF A01; 1		DE85752504	MN -95	10:44565
LPC-					
84-24	NTIS (US Sales Only), PC A02/MF A01		DE85752075	MN -34C	10:45760
84-28	NTIS (US Sales Only), PC A03/MF A01		DE85752065	MN -34D	10:45511
LYCEN-					
8364	NTIS (US Sales Only), PC A03/MF A01		DE85752036	MN -34D	10:45710
8403	NTIS (US Sales Only), PC A02/MF A01		DE85752035	MN -34D	10:45711
8460	NTIS (US Sales Only), PC A02/MF A01		DE85752042	MN -34D	10:45512
MAD/PH-					
232	*See* DESY-85-032		DE85752132	MN -34D	10:45471
MAFF-FRTR-					
77	NTIS (US Sales Only), PC A02/MF A01		DE85702019	MN -37	10:45021
MINTEK-M-					
172	NTIS (US Sales Only), PC A02/MF A01		DE85702042	MN -32	10:45022
MIT/CE-					
7862-02	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE85015813	MN -90h	10:43631
MIT/EL-					
84-004WP	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017260	MN -90b	10:43704
MIT/R-					
84-07	*See* MIT/CE-7862-02	E 1.99:	DE85015813	MN -90h	10:43631
MLM-					
3273(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016449	MN -4	10:44782
3274	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016447	MN -15	10:44751
3280(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016445	MN -38	10:45054
3281(OP)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016450	MN -25	10:44669
MR-N-					
175	*See* AD-A-954462/8/XAB				10:44689
MRC-R-					
845	*See* AD-A-154376/8/XAB				10:44830
MTR-					
82W181	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016467	MN -59A	10:44071
NAC-AR-					
83-01	NTIS (US Sales Only), PC A12/MF A01		DE85781534	MN -28	10:44989
NARF-					
58-5T	*See* AD-A-954462/8/XAB				10:44689
NASA-CR-					
168046	*See* DOE/NASA-0200-1	E 1.99:	DE85017168	MN -60	10:44140
168047	*See* DOE/NASA-0200-2	E 1.99:	DE85017169	MN -60	10:44141
NBS/TN-					
1201	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85016791	MN -95d	10:44547
1213	*See* PB-85-206068/XAB				10:44755
NBSIR-					
85-3197	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016820	MN -59A	10:44093
NCEL-TR-					
912	*See* AD-A-154909/6/XAB				10:44521
914	*See* AD-A-154651/4/XAB				10:44520
NDL-TR-					
53(EX)	*See* AD-A-995235/9/XAB				10:45063
NE-					
07-85-Master-Index	Performance Assurance Project Office, ORNL, Box Y, Bldg. 9204-1, M/S 110, Rm. 321, Oak Ridge, TN; 1		TI85015114	ND -80	10:44282
NEANDC(J)-					
96/ U	NTIS (US Sales Only), PC A05/MF A01		DE84900755	MN -34C	10:45678
NIKHEF-H-					
84-10	NTIS (US Sales Only), PC A02/MF A01		DE85702021	MN -37	10:45023
84-12	NTIS (US Sales Only), PC A03/MF A01		DE85701920	MN -34D	10:45563
84-13	NTIS (US Sales Only), PC A02/MF A01		DE85701918	MN -34D	10:45564
84-14	NTIS (US Sales Only), PC A02/MF A01		DE85701927	MN -34D	10:45513
84-15	NTIS (US Sales Only), PC A02/MF A01		DE85701922	MN -34A	10:45514
84-16	NTIS (US Sales Only), PC A02/MF A01		DE85701931	MN -34D	10:45454
NLCO-					
2028	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017323	MN -41	10:43891
NMERDI-					
2-72-4212	NTIS, PC A04/MF A01 - NMERDI, Univ. of New Mexico, 457 Washington SE, Suite M, Albuquerque, NM 87108		DE85902052	MN -59A	10:44072
NP-					
5752493	Smidth (F.L.), Copenhagen (Denmark)			ND -90i	10:44925
5752494	NTIS (US Sales Only), PC A05/MF A01; 1		DE85752494	MN -92	10:43710
5752495	NTIS (US Sales Only), PC A10/MF A01		DE85752495	MN -60	10:44150
5752501	NTIS (US Sales Only), PC A05/MF A01		DE85752501	MN -98E	10:44507
5901714	NTIS, PC A23/MF A01; 1		DE85901714	MN -11	10:45151
NRAS-					
70/ UNUP-556	NTIS (US Sales Only), PC A03/MF A01		DE85901708	MN -13	10:43973
NRL-Memo-					
4259	*See* NUREG/CR-1119		TI85015778	MN -78	10:44294
NRL-MR-					
5541	*See* AD-A-154995/5/XAB				10:45569

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
5552	See AD-A-154902/1/XAB			10:45778
NSWC-TR-				
83-366	See AD-A-154233/1/XAB			10:44446
NUCLEBRAS-CDTN-				
486	NTIS (US Sales Only), PC A05/MF A01	DE85781557	MN -11	10:45177
NUREG-				
0304-Vol.10-No.2	NTIS, PC A05/MF A01 - GPO	TI85901869	MN -2	10:44275
0748-Vol.5-No.6	NTIS, PC A16/MF A01 - GPO	TI85901970	MN -80	10:44276
0750-Vol.21-No.5	NTIS, PC A23/MF A01 - GPO	TI85902049	MN -78	10:44277
0936-Vol.4-No.2	NTIS, PC A10/MF A01 - GPO	TI85902003	MN -80	10:44278
0940-Vol.4-No.2	NTIS, PC A15/MF A01 - GPO	TI85902011	MN -80	10:44279
1141	NTIS, PC A21/MF A01 - GPO	TI85901874	MN -78	10:44280
1155-Vol.2	NTIS, PC A02/MF A01 - GPO	TI85901967	MN -78	10:44292
1155-Vol.4	NTIS, PC A02/MF A01 - GPO	TI85901969	MN -78	10:44311
NUREG/CR-				
0524	NTIS, PC A03/MF A01 - GPO	TI85015874	MN -78	10:44293
0672-Vol.1	NTIS, PC A14/MF A01 - GPO	TI85015936	MN -78	10:44368
0729	NTIS PC E04/MF A01 - GPO	TI85015867	MN -78	10:44369
0731	NTIS PC E04/MF A01	TI85015948	MN -78	10:44370
0734	NTIS PC E03/MF A01 - GPO	TI85015868	MN -78	10:44371
0735	NTIS PC E04/MF A01	TI85015869	MN -78	10:44372
0750	NTIS, PC A05/MF A01 - GPO	TI85015940	MN -78	10:44318
0891	NTIS, PC A09/MF A01 - GPO	TI85015864	MN -78	10:44373
1119	NTIS, PC A05/MF A01 - GPO	TI85015778	MN -78	10:44294
1179	NTIS, PC A07/MF A01 - GPO	TI85015862	MN -78	10:44374
1197	NTIS, PC A06/MF A01 - GPO	TI85015881	MN -78	10:44212
1274	NTIS, PC A04/MF A01 - GPO	TI85015944	MN -78	10:44375
1339	NTIS, PC A06/MF A01 - GPO	TI85015858	MN -78	10:44305
1347	NTIS, PC A04/MF A01 - GPO	TI85015942	MN -78	10:44376
1359	NTIS, PC A04/MF A01 - GPO	TI85015859	MN -78	10:44377
1382	NTIS, PC A04/MF A01 - GPO	TI85015876	MN -78	10:44329
1499	NTIS, PC A05/MF A01 - GPO	TI85015917	MN -78	10:44295
1506	NTIS, PC A04/MF A01 - GPO	TI85015918	MN -78	10:44378
1529	NTIS, PC A03/MF A01 - GPO	TI85015905	MN -78	10:44379
1540	NTIS, PC A03/MF A01 - GPO	TI85015904	MN -78	10:44380
1567	NTIS, PC A03/MF A01 - GPO	TI85015901	MN -78	10:44381
1603	NTIS, PC A09/MF A01 - GPO	TI85015909	MN -78	10:44232
1606	NTIS, PC A05/MF A01 - GPO $3.75	TI85015921	MN -78	10:44233
1624-Vol.2	NTIS, PC A03/MF A01 - GPO	TI85015907	MN -78	10:44382
1645	NTIS, PC A03/MF A01 - GPO	TI85015957	MN -78	10:44383
1691	NTIS, PC A02/MF A01 - GPO	TI85015878	MN -78	10:44384
1695	NTIS, PC A13/MF A01 - GPO	TI85015880	MN -78	10:44385
1709	NTIS, PC A05/MF A01 - GPO	TI85015885	MN -78	10:44386
1710-Vol.2	NTIS, PC A04/MF A01 - GPO	TI85015879	MN -78	10:44330
1723	NTIS, PC A03/MF A01 - GPO	TI85015894	MN -78	10:44387
1773	NTIS, PC A03/MF A01 - GPO	TI85015897	MN -78	10:44388
1800	NTIS, PC A04/MF A01 - GPO	TI85015884	MN -78	10:44389
1806	NTIS, PC A04/MF A01 - GPO	TI85015926	MN -78	10:44296
1828	NTIS, PC A02/MF A01 - GPO	TI85015928	MN -78	10:44234
1833	NTIS, PC A09/MF A01 - GPO	TI85015929	MN -78	10:44390
1859	NTIS, PC A07/MF A01 - GPO	TI85015930	MN -78	10:44391
1880	NTIS, PC A03/MF A01 - GPO	TI85015932	MN -78	10:44392
1908	NTIS, PC A06/MF A01 - GPO	TI85015985	MN -78	10:44393
1909	NTIS, PC A04/MF A01 - GPO	TI85016687	MN -78	10:44394
1912	NTIS, PC A03/MF A01 - GPO	TI85016008	MN -78	10:44213
1917	NTIS, PC A03/MF A01 - GPO	TI85015983	MN -78	10:44306
1919	NTIS, PC A03/MF A01 - GPO	TI85016007	MN -78	10:44395
1938	NTIS, PC A05/MF A01 - GPO $4.00	TI85016013	MN -78	10:44297
1944	NTIS, PC A04/MF A01 - GPO	TI85015979	MN -78	10:44396
1946	NTIS, PC A03/MF A01 - GPO	TI85015980	MN -78	10:44397
1958	NTIS, PC A05/MF A01 - GPO	TI85016009	MN -78	10:44235
1981	NTIS, PC A08/MF A01 - GPO	TI85016019	MN -78	10:44398
1991	NTIS, PC A03/MF A01 - GPO	TI85015982	MN -78	10:44399
2000-Vol.4-No.6	NTIS, PC A07/MF A01 - GPO	TI85015839	MN -78	10:44400
2020	NTIS, PC A02/MF A01 - GPO	TI85015976	MN -78	10:44401
2052	NTIS, PC A06/MF A01 - GPO	TI85016003	MN -78	10:44402
2054	NTIS, PC A18/MF A01 - GPO	TI85015981	MN -78	10:44403
2114	NTIS, PC A06/MF A01 - GPO	TI85016000	MN -78	10:44404
2149	NTIS, PC A02/MF A01 - GPO	TI85016037	MN -78	10:44236
2160	NTIS, PC A04/MF A01 - GPO	TI85016036	MN -78	10:44405
2182-Vol.1	NTIS, PC A11/MF A01 - GPO	TI85015988	MN -78	10:44406
2189-Vol.3	NTIS, PC A04/MF A01 - GPO	TI85016044	MN -78	10:44407
2204-Vol.1	NTIS, PC A02/MF A01 - GPO	TI85016024	MN -78	10:44408
2227	NTIS, PC A09/MF A01 - GPO	TI85015996	MN -78	10:44319
2294	NTIS, PC A06/MF A01	TI85016021	MN -78	10:44901
2305-Vol.1	NTIS, PC A02/MF A01 - GPO	TI85015993	MN -78	10:44237
2332	NTIS, PC A03/MF A01 - GPO	TI85015997	MN -78	10:44298
2363	NTIS, PC A02/MF A01 - GPO	TI85015992	MN -78	10:44409
2366-Vol.1	NTIS, PC A09/MF A01 - GPO	TI85015998	MN -78	10:44410
2486	NTIS, PC A04/MF A01 - GPO	TI85015999	MN -78	10:44411
3736	NTIS, PC A06/MF A01 - GPO	TI85902090	MN -11	10:45290
3900-Vol.4	NTIS, PC A11/MF A01 - GPO	TI85902045	MN -71	10:44639
3952	NTIS, PC A03/MF A01 - GPO	TI85011358	MN -78	10:44238
4107	NTIS, PC A03/MF A01 - GPO	TI85016543	MN -15	10:43908

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4119	NTIS, PC A03/MF A01 - GPO		TI85016540	MN -78	10:44412
4227	NTIS, PC A23/MF A01 - GPO		TI85016435	MN -80	10:44312
4281	NTIS, PC A04/MF A01 - GPO		TI85016166	MN -80	10:44413
4300-Vol.1	NTIS, PC A03/MF A01 - GPO		TI85016647	MN -78	10:44239
4304	NTIS, PC A08/MF A01 - GPO		TI85017300	MN -78	10:44414
4331	NTIS, PC A09/MF A01 - GPO		TI85016786	MN -11	10:44415
4334	NTIS, PC A14/MF A01 - GPO		TI85017151	MN -11	10:44416
4352	NTIS, PC A03/MF A01 - GPO		TI85902093	MN -70B	10:43862
4354	NTIS, PC A05/MF A01 - GPO		TI85902061	MN -11	10:45300
NUREG-tr-					
0014	NTIS, PC A03/MF A01 - GPO		TI85901905	MN -78	10:44417
0017	NTIS, PC A03/MF A01 - GPO		TI85901902	MN -78	10:44441
0021	NTIS, PC A03/MF A01 - GPO		TI85901901	MN -78	10:44440
0026	NTIS, PC A05 - GPO		DE85901898	MN -78	10:44439
0054	NTIS, PC A06 - GPO		DE85901907	MN -78	10:44438
NYSERDA-					
85-7	NYSERDA, Two Rockefeller Plaza, Albany, NY 12223		TI85901508	MN -90b	10:43693
OA-tr-					
2724	NTIS, PC A02/MF A01		DE85901479	MN -94a	10:44569
OH-					
83-319-K	NTIS (US Sales Only), PC A02/MF A01		DE85702015	MN -80	10:44250
83-457-K	NTIS (US Sales Only), PC A03/MF A01		DE85701944	MN -25	10:44251
OLS-					
84-115-Vol.3	*See* DOE-tr-273-Vol.3	E 1.99:	DE85013333	MN -90g	10:44513
84-115-Vol.4	*See* DOE-tr-273-Vol.4	E 1.99:	DE85012783	MN -93	10:44514
ONWI-					
290	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85011699	MN -70	10:43863
ORNL-					
6177	*See* NUREG/CR-4304		TI85017300	MN -78	10:44414
ORNL/LMR/SP-					
85/ 6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85014819	MN -79	10:44271
ORNL/NSIC-					
200-Vol.4-No.6	*See* NUREG/CR-2000-Vol.4-No.6		TI85015839	MN -78	10:44400
ORNL/NUREG-					
62	*See* NUREG/CR-1347		TI85015942	MN -78	10:44376
65	*See* NUREG/CR-1359		TI85015859	MN -78	10:44377
72	*See* NUREG/CR-1529		TI85015905	MN -78	10:44379
ORNL/NUREG/CSD/TM-					
14	*See* NUREG/CR-1499		TI85015917	MN -78	10:44295
17	*See* NUREG/CR-1709		TI85015885	MN -78	10:44386
19	*See* NUREG/CR-1917		TI85015983	MN -78	10:44306
ORNL/NUREG/TM-					
254	*See* NUREG/CR-0524		TI85015874	MN -78	10:44293
277	*See* NUREG/CR-0729		TI85015867	MN -78	10:44369
302	*See* NUREG/CR-0731		TI85015948	MN -78	10:44370
305	*See* NUREG/CR-0734		TI85015868	MN -78	10:44371
306	*See* NUREG/CR-0735		TI85015869	MN -78	10:44372
369	*See* NUREG/CR-1274		TI85015944	MN -78	10:44375
370	*See* NUREG/CR-1197		TI85015881	MN -78	10:44212
388	*See* NUREG/CR-1773		TI85015897	MN -78	10:44388
389	*See* NUREG/CR-1909		TI85016687	MN -78	10:44394
405/ P2	*See* NUREG/CR-1710-Vol.2		TI85015879	MN -78	10:44330
412	*See* NUREG/CR-1723		TI85015894	MN -78	10:44387
419	*See* NUREG/CR-1806		TI85015926	MN -78	10:44296
420	*See* NUREG/CR-1828		TI85015928	MN -78	10:44234
434	*See* NUREG/CR-1908		TI85015985	MN -78	10:44393
436	*See* NUREG/CR-1919		TI85016007	MN -78	10:44395
445	*See* NUREG/CR-2052		TI85016003	MN -78	10:44402
446	*See* NUREG/CR-2114		TI85016000	MN -78	10:44404
449	*See* NUREG/CR-2020		TI85015976	MN -78	10:44401
455/ V1	*See* NUREG/CR-2182-Vol.1		TI85015988	MN -78	10:44406
ORNL/Sub-					
81/ 7755/ 1	*See* NUREG/CR-2294		TI85016021	MN -78	10:44901
83-51926/ 2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016739	MN -25	10:44915
ORNL/TM-					
7836	*See* NUREG/CR-2149		TI85016037	MN -78	10:44236
7877	*See* NUREG/CR-2204-Vol.1		TI85016024	MN -78	10:44408
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9530	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85015051	STD -94a	10:44445
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9588	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85013213	MN -41	10:45132
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9730	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016910	MN -70A	10:43864
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3346-264	*See* DOE/ER/03346-264	E 1.99:	DE85016956	MN -34C	10:45659
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84-43	*See* PB-85-202216/XAB				10:44456
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3835	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85013221	MN -80	10:44418
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84-156	NTIS (US Sales Only), PC A03/MF A01		DE85702020	MN -37	10:45026
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6-1984	NTIS (US Sales Only), PC A03/MF A01		DE85751153	MN -11	10:45128
7-1984	NTIS (US Sales Only), PC A03/MF A01		DE85751206	MN -11	10:45179
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UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
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US United States of America (USA)
UY Uruguay

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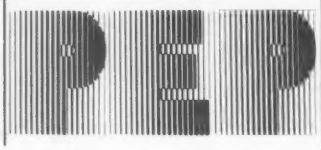

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